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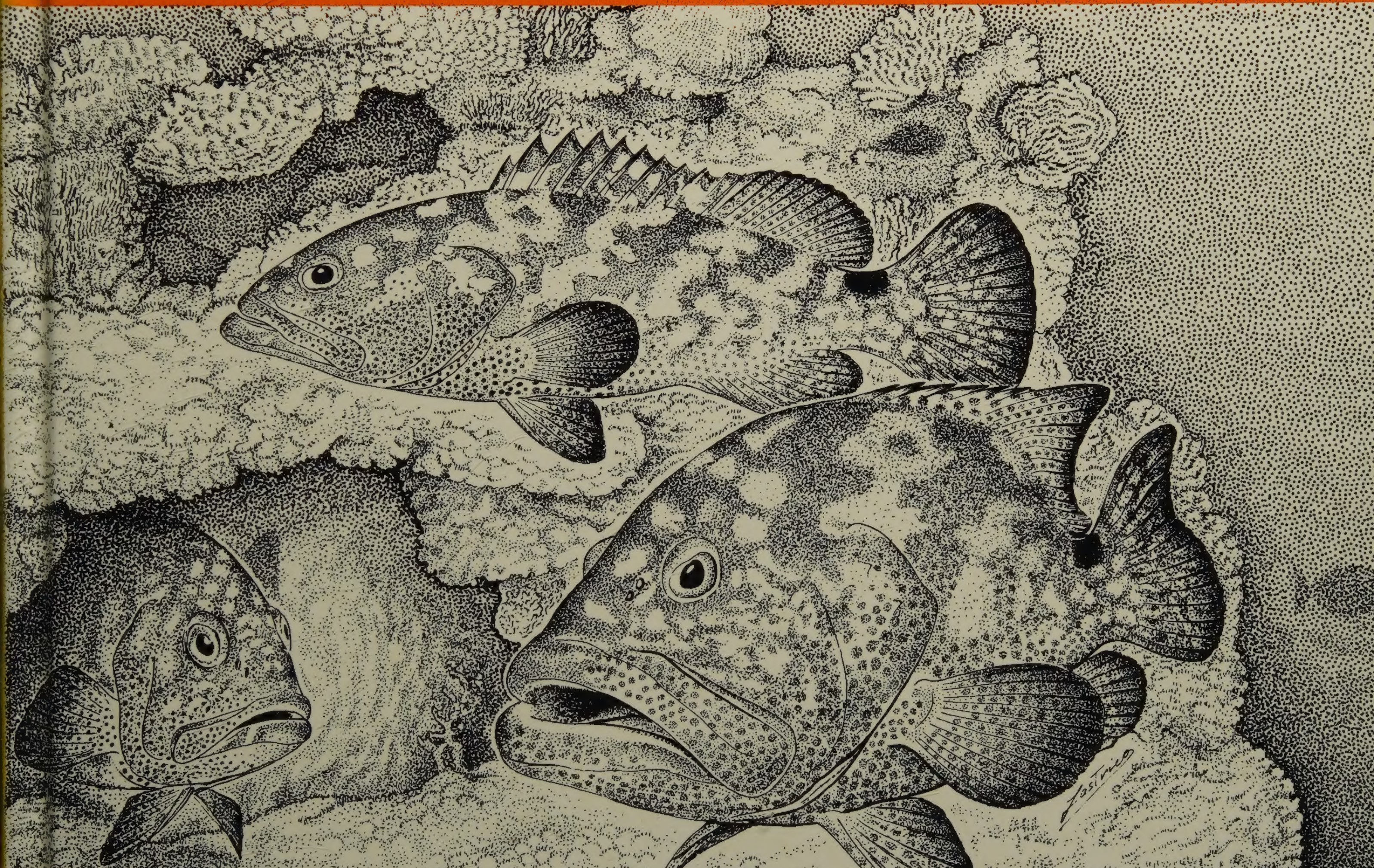
FAO SPECIES CATALOGUE

VOL. 16. GROUPERS OF THE WORLD

(FAMILY SERRANIDAE, SUBFAMILY EPINEPHELINAE)

AN ANNOTATED AND ILLUSTRATED CATALOGUE OF THE
GROUPER, ROCKCOD, HIND, CORAL GROUPER, AND LYRETAIL SPECIES
KNOWN TO DATE



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FAO Fisheries Synopsis No. 125, Volume 16 FIR/S125 Vol. 16

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VOL. 16. GROUPERS OF THE WORLD

(Family Serranidae, Subfamily Epinephelinae)
An Annotated and Illustrated Catalogue of the Grouper,
Rockcod, Hind, Coral Grouper and Lyretail Species

Known to Date

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Rome, 1993

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PREPARATION OF THIS DOCUMENT

This document was prepared under the FAO Fisheries Department Regular Programme in the Marine Resources Service of the Fishery Resources and Environment Division. It is the sixteenth worldwide species catalogue in the FAO Fisheries Synopsis series.

The serranid subfamily Epinephelinae is important in commercial, artisanal, and sport fisheries of tropical and subtropical seas. However, detailed fishery information is usually not available, largely because of the difficulty in correctly identifying species. This difficulty is because of past taxonomic confusion, the similarity of colour pattern of some species, and ontogenetic changes and other variations in colour patterns. Therefore, this catalogue is timely as an accurate and complete worldwide guide to the identification of groupers. It is intended to help fisheries workers gather statistics and examine aspects of their biology that will be useful for the management of this fishery resource. The authors of the catalogue have studied groupers for many years by examining countless specimens, including most types, in museums, markets, and underwater on reefs, throughout the world. They have authored numerous scientific articles on groupers and recently completed a revision of the Epinephelinae from the Indo-Pacific region which was published in "Indo-Pacific Fishes," Honolulu, Hawaii, No. 20, November, 1991. This publication was the source for most of the taxonomic and ecological information for species occurring in that region.

English FAO fish names proposed by the authors were established in consultation with J.S. Nelson, University of Alberta, Edmonton (Chairman, Committee on Common Names of Fishes, American Fisheries Society and American Society of Ichthyologists and Herpetologists). Official French names were created in consultation with J.-C. Quero, Institut Français de Recherche pour l'Exploitation de la Mer, la Rochelle. Spanish FAO names were adapted from the literature or translated from the English FAO names with the help of G. Burgos, Instituto Nacional de Investigación and Desarollo Pesquero, Argentina.

In view of the importance of colour patterns as diagnostic characters for identification, colour plates for most species have been included.

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ABSTRACT

This is the sixteenth issue in the FAO series of worldwide annotated and illustrated catalogues of major groups of organisms that enter marine fisheries. It contains the 159 species in 15 genera known from the serranid subfamily Epinephelinae, including one species new to science. There is an introductory section with general remarks on habitat and fisheries of the family, a glossary of technical terms, an illustrated key to each genus and all species, and a detailed account for all species. Species accounts include an illustration of each species, scientific and vernacular names, and information on habitat, biology, fisheries, size, relevant literature, and distribution. Following the species accounts are a list of nominal species in the subfamily, a table of species by major marine fishing areas, and colour plates. A list of all nominal species and their present allocations is given. The work is fully indexed and there is a comprehensive list of references to pertinent literature.

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Many people have assisted with the preparation of this catalogue and our research on serranid fishes. We are particularly grateful to the artists: Elaine Heemstra (formerly Elaine Grant) and David Voorvelt, of the J.L.B. Smith Institute, and Paolo Lastrico, of the FAO Fisheries Department, for their excellent illustrations. Additional important contributions were the meticulous work of Joan Wright, P.C. Heemstra's Research Assistant, and Helen A. Randall, Managing Editor of *Indo-Pacific Fishes*.

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Table of Contents

PAGE

Preparation of this Document . . . iii
Abstract . . . iii
Acknowledgements . . . iv
1. INTRODUCTION . . . **1**
1.1 Habitat and Biology . . . 1
1.2 Fisheries . . . 4
1.3 Classification of the Family Serranidae . . . 4
1.4 Illustrated Glossary of Tecnical Terms and Measurements . . . 6
1.5 Plan of the Catalogue . . . 10
2. SYSTEMATIC CATALOGUE . . . **11**
2.1 Diagnostic Features of the Subfamily Epinephelinae . . . 11
2.2 Notes on the Identification of Groupers . . . 11
2.3 Illustrated Key to the Genera of Groupers . . . 12
2.4 Information by Genus and Species . . . 16

	CODE	
Aethaloperca	SERRAN Aethal	16
Aethaloperca rogaa	SERRAN Aethal 1	16
Alphestes	SERRAN Alph	18
Alphestes afer	SERRAN Alph 1	20
Alphestes immaculatus	SERRAN Alph 2	21
Alphestes multiguttatus	SERRAN Alph 3	22
Anyperodon	SERRAN Anyper	23
Anyperodon leucogrammicus	SERRAN Anyper 1	23
Cephalopholis	SERRAN Cephal	25
Cephalopholis aitha	SERRAN Cephal 22	33
Cephalopholis argus	SERRAN Cephal 9	34
Cephalopholis aurantia	SERRAN Cephal 10	35
Cephalopholis boenak	SERRAN Cephal 11	37
Cephalopholis cruentata	SERRAN Cephal 4	38
Cephalopholis cyanostigma	SERRAN Cephal 19	40
Cephalopholis formosa	SERRAN Cephal 12	42
Cephalopholis fulva	SERRAN Cephal 5	43
Cephalopholis hemistiktos	SERRAN Cephal 13	44
Cephalopholis igarashiensis	SERRAN Cephal 20	46
Cephalopholis leopardus	SERRAN Cephal 14	47
Cephalopholis microprion	SERRAN Cephal 21	48
Cephalopholis miniata	SERRAN Cephal 1	49
Cephalopholis nigri	SERRAN Cephal 6	51
Cephalopholis oligosticta	SERRAN Cephal 16	52
Cephalopholis panamensis	SERRAN Cephal 18	53
Cephalopholis polleni	SERRAN Cephal 23	54
Cephalopholis sexmaculata	SERRAN Cephal 17	55
Cephalopholis sonnerati	SERRAN Cephal 3	57
Cephalopholis spiloparaea	SERRAN Cephal 8	58
Cephalopholis taeniops	SERRAN Cephal 7	60
Cephalopholis urodeta	SERRAN Cephal 15	61
Cromileptes	SERRAN Cromil	63
Cromileptes altivelis	SERRAN Cromil 1	63

	CODE	PAGE
Dermatolepis	SERRAN Dermat	64
Dermatolepis dermatolepis	SERRAN Dermat 3	65
Dermatolepis inermis	SERRAN Dermat 1	66
Dermatolepis striolata	SERRAN Dermat 2	68
Epinephelus	SERRAN Epin	69
Epinephelus acanthistius	SERRAN Epin 59	102
Epinephelus adscensionis	SERRAN Epin 13	103
Epinephelus aeneus	SERRAN Epin 3	104
Epinephelus akaara	SERRAN Epin 66	106
Epinephelus albomarginatus	SERRAN Epin 26	108
Epinephelus amblycephalus	SERRAN Epin 74	109
Epinephelus analogus	SERRAN Epin 60	110
Epinephelus andersoni	SERRAN Epin 27	111
Epinephelus areolatus	SERRAN Epin 4	112
Epinephelus awoara	SERRAN Epin 5	114
Epinephelus bilobatus	SERRAN Epin 82	115
Epinephelus bleekeri	SERRAN Epin 6	117
Epinephelus bontoides	SERRAN Epin 86	118
Epinephelus bruneus	SERRAN Epin 7	119
Epinephelus caeruleopunctatus	SERRAN Epin 28	120
Epinephelus caninus	SERRAN Epin 23	122
Epinephelus chabaudi	SERRAN Epin 43	124
Epinephelus chlorocephalus	SERRAN Epin 65	126
Epinephelus chlorostigma	SERRAN Epin 29	127
Epinephelus cifuentesi	SERRAN Epin 61	129
Epinephelus coioides	SERRAN Epin 67	130
Epinephelus corallicola	SERRAN Epin 68	132
Epinephelus costae	SERRAN Epin 2	134
Epinephelus cyanopodus	SERRAN Epin 69	136
Epinephelus daemelii	SERRAN Epin 70	138
Epinephelus darwinensis	SERRAN Epin 71	139
Epinephelus diacanthus	SERRAN Epin 30	140
Epinephelus drummondhayi	SERRAN Epin 14	142
Epinephelus epistictus	SERRAN Epin 31	143
Epinephelus ergastularius	SERRAN Epin 72	145
Epinephelus erythrurus	SERRAN Epin 73	146
Epinephelus exsul	SERRAN Epin 62	147
Epinephelus fasciatomaculosus	SERRAN Epin 75	148
Epinephelus fasciatus	SERRAN Epin 8	150
Epinephelus faveatus	SERRAN Epin 49	152
Epinephelus flavocaeruleus	SERRAN Epin 33	154
Epinephelus flavolimbatus	SERRAN Epin 15	155
Epinephelus fuscoguttatus	SERRAN Epin 9	156
Epinephelus gabriellae	SERRAN Epin 77	158
Epinephelus goreensis	SERRAN Epin 25	159
Epinephelus guttatus	SERRAN Epin 16	161
Epinephelus haifensis	SERRAN Epin 58	162
Epinephelus heniochus	SERRAN Epin 78	164
Epinephelus hexagonatus	SERRAN Epin 34	165
Epinephelus howlandi	SERRAN Epin 79	167
Epinephelus indistinctus	SERRAN Epin 80	168
Epinephelus irroratus	SERRAN Epin 81	169
Epinephelus itajara	SERRAN Epin 17	171

	CODE	PAGE
Epinephelus labriformis	SERRAN Epin 63	173
Epinephelus lanceolatus	SERRAN Epin 83	174
Epinephelus latifasciatus	SERRAN Epin 35	176
Epinephelus lebretonianus	SERRAN Epin 84	177
Epinephelus longispinis	SERRAN Epin 36	178
Epinephelus macrospilos	SERRAN Epin 32	179
Epinephelus maculatus	SERRAN Epin 85	181
Epinephelus magniscuttis	SERRAN Epin 37	182
Epinephelus malabaricus	SERRAN Epin 38	184
Epinephelus marginatus	SERRAN Epin 1	186
Epinephelus melanostigma	SERRAN Epin 39	189
Epinephelus merra	SERRAN Epin 40	191
Epinephelus miliaris	SERRAN Epin 42	193
Epinephelus morio	SERRAN Epin 18	195
Epinephelus morrhua	SERRAN Epin 44	196
Epinephelus multinotatus	SERRAN Epin 45	198
Epinephelus mystacinus	SERRAN Epin 19	200
Epinephelus nigritus	SERRAN Epin 20	201
Epinephelus niphobles	SERRAN Epin 64	203
Epinephelus niveatus	SERRAN Epin 21	204
Epinephelus octofasciatus	SERRAN Epin 53	206
Epinephelus ongus	SERRAN Epin 46	208
Epinephelus perplexus	SERRAN Epin 87	210
Epinephelus poecilonotus	SERRAN Epin 47	211
Epinephelus polylepis	SERRAN Epin 88	213
Epinephelus polyphekadion	SERRAN Epin 41	214
Epinephelus polystigma	SERRAN Epin 89	216
Epinephelus posteli	SERRAN Epin 48	217
Epinephelus quernus	SERRAN Epin 90	218
Epinephelus quoyanus	SERRAN Epin 10	220
Epinephelus radiatus	SERRAN Epin 50	222
Epinephelus retouti	SERRAN Epin 51	224
Epinephelus rivulatus	SERRAN Epin 52	225
Epinephelus septemfasciatus	SERRAN Epin 91	227
Epinephelus sexfasciatus	SERRAN Epin 92	229
Epinephelus socialis	SERRAN Epin 93	230
Epinephelus spilotoceps	SERRAN Epin 54	232
Epinephelus stictus	SERRAN Epin 94	234
Epinephelus stoliczkae	SERRAN Epin 55	235
Epinephelus striatus	SERRAN Epin 22	236
Epinephelus suborbitalis	SERRAN Epin 95	238
Epinephelus summana	SERRAN Epin 11	239
Epinephelus tauvina	SERRAN Epin 12	241
Epinephelus timorensis	SERRAN Epin 96	243
Epinephelus trimaculatus	SERRAN Epin 97	244
Epinephelus trophis	SERRAN Epin 98	245
Epinephelus tuamotuensis	SERRAN Epin 99	246
Epinephelus tukula	SERRAN Epin 56	248
Epinephelus undulatostriatus	SERRAN Epin 76	249
Epinephelus undulosus	SERRAN Epin 57	250
Gonioplectrus	SERRAN Gonio	252
Gonioplectrus hispanus	SERRAN Gonio 1	252

	CODE	PAGE
Gracila	SERRAN Gracil	254
Gracila albomarginata	SERRAN Gracil 1	254
Mycteroperca	SERRAN Myct	256
Mycteroperca acutirostris	SERRAN Myct 14	261
Mycteroperca bonaci	SERRAN Myct 1	262
Mycteroperca cidi	SERRAN Myct 2	264
Mycteroperca fusca	SERRAN Myct 15	265
Mycteroperca interstitialis	SERRAN Myct 3	266
Mycteroperca jordani	SERRAN Myct 9	268
Mycteroperca microlepis	SERRAN Myct 4	269
Mycteroperca olfax	SERRAN Myct 10	270
Mycteroperca phenax	SERRAN Myct 5	271
Mycteroperca prionura	SERRAN Myct 11	273
Mycteroperca rosacea	SERRAN Myct 12	274
Mycteroperca rubra	SERRAN Myct 6	275
Mycteroperca tigris	SERRAN Myct 7	276
Mycteroperca venenosa	SERRAN Myct 8	278
Mycteroperca xenarcha	SERRAN Myct 13	280
Paranthias	SERRAN Parant	281
Paranthias colonus	SERRAN Parant 2	283
Paranthias furcifer	SERRAN Parant 1	284
Plectropomus	SERRAN Plect	285
Plectropomus areolatus	SERRAN Plect 2	289
Plectropomus laevis	SERRAN Plect 3	290
Plectropomus leopardus	SERRAN Plect 1	292
Plectropomus maculatus	SERRAN Plect 4	293
Plectropomus oligacanthus	SERRAN Plect 6	295
Plectropomus pessuliferus	SERRAN Plect 7	296
Plectropomus punctatus	SERRAN Plect 5	297
Saloptia	SERRAN Salop	298
Saloptia powelli	SERRAN Salop 1	299
Triso	SERRAN Triso	300
Triso dermopterus	SERRAN Triso 1	300
Variola	SERRAN Vari	301
Variola albimarginata	SERRAN Vari 2	303
Variola louti	SERRAN Vari 1	304

3. LIST OF NOMINAL SPECIES 306

4. LIST OF SPECIES BY MAJOR FISHING AREAS 317

5. BIBLIOGRAPHY 325

6. INDEX OF SCIENTIFIC AND VERNACULAR NAMES 356

7. COLOUR PLATES 379

1. INTRODUCTION

The serranid Subfamily Epinephelinae comprises about 159 species of marine fishes in 15 genera (Fig. 1), commonly known as groupers, rockcods, hinds, and seabasses. These species are of considerable economic value, especially in the coastal fisheries of tropical and subtropical areas. It has been estimated that 90% of the world's harvest of marine food is derived from artisanal fisheries, and groupers are a major component of the artisanal fisheries resource. Although groupers are usually the most expensive fishes in local markets, separate catch statistics are not reported for most species, and landings are often summarized as "serranids" or "groupers." This lack of species-specific catch data is due, in part, to the difficulty of identifying many of the species. For example, two of the most important commercial species, "*Epinephelus guaza*" (of the Mediterranean and Atlantic Ocean) and *E. tauvina* (of the Indo-Pacific region) are often misidentified. The importance of correct species identification should be obvious to every biologist and is certainly appreciated by intelligent farmers and taxonomists. It is essential for the proper management of a fishery resource to correctly identify the species concerned.

The purposes of this grouper catalogue are (1) to provide a means of identifying the various species, (2) to present a synopsis of the literature on the biology and fisheries of these species, and (3) to present a new generic-level classification of the groupers.

The Indo-Pacific groupers (110 species) were revised by Randall and Heemstra (1991), and that work is incorporated in the present catalogue. Heemstra (1991) completed a taxonomic revision of the 14 species of groupers that occur in the eastern Atlantic Ocean and Mediterranean Sea. The results of this revision are also included in the present catalogue. The reader is advised to consult these two revisions for taxonomic details.

Our treatment of the American groupers was greatly facilitated by the excellent revision by C.L. Smith (1971). With a few exceptions, we recognize the same species as Smith did. Where we differ with Smith, we have given additional data and a detailed explication of our taxonomic conclusions. The first author (P.C.H.) did the research on American groupers and accepts full responsibility for any errors concerning these species.

1.1 Habitat and Biology

Groupers are bottom-associated fishes found in the tropical and subtropical waters of all oceans. Most species occur on coral reefs, but some live in estuaries or on rocky reefs. Groupers are generally associated with hard (rocky) bottoms, although juveniles are found in seagrass beds, and adults of a few species prefer sandy or silty areas. Some species occur in depths of 100 to 200 m (occasionally to 500 m); however, the majority inhabit depths less than 100 m, and juveniles are often found in tidepools.

As the major predators of the coral-reef ecosystem, most groupers feed on a variety of fishes, larger crustaceans, and cephalopods . A few groupers (e.g., *Paranthias* spp., *Epinephelus undulosus*) have long, numerous gill rakers and are thus adapted for plankton feeding. Adults of many species (e.g., *Plectropomus* spp., *Variola louti*) are primarily piscivorous, and they are usually seen cruising the reef or shallows in search of their prey. Most groupers are ambush predators, hiding amongst the coral and rocks until an unwary fish or crustacean goes by, then catching their prey with a quick rush and snap of their jaws. The large head and mouth of the typical grouper enables it to suck in a large volume of water (and the prey) in less than a second. The numerous inwardly-depressible sharp teeth are well adapted for seizing the prey and preventing its escape from the mouth. Some groupers have been observed following moray eels (and occasionally other fish) as they forage over the reef, in order to catch the small fishes and crustaceans that are frightened from their hiding places by the eels.

Except for occasional spawning aggregations, most species are solitary fishes; and tagging studies have shown that groupers are generally resident on a particular reef for long periods of time (often years). This site specificity and the relatively slow growth rate of groupers make them particularly vulnerable to over-fishing. In addition, some groupers use localized spawning sites to which they migrate from distances of several kilometres; and these sites are often exploited by local fishermen who catch large numbers of fishes during the brief spawning period of 1 or 2 weeks. This removal of a considerable number of reproductively active fish from the population may be detrimental to sustained yields of the fishery. Although an individual male may spawn several times during the breeding period, there is no evidence to suggest that females spawn more than once a year. Some species (e.g., *Epinephelus akaara*) spawn in pairs, others (e.g., *E. striatus*) spawn in large aggregations.

Judging from the few species that have been studied, groupers are protogynous hermaphrodites. The gonad lies ventral and slightly posterior to the swim bladder. The ovary is in the form of a bilobed sac that unites posteriorly to form a common ovi-

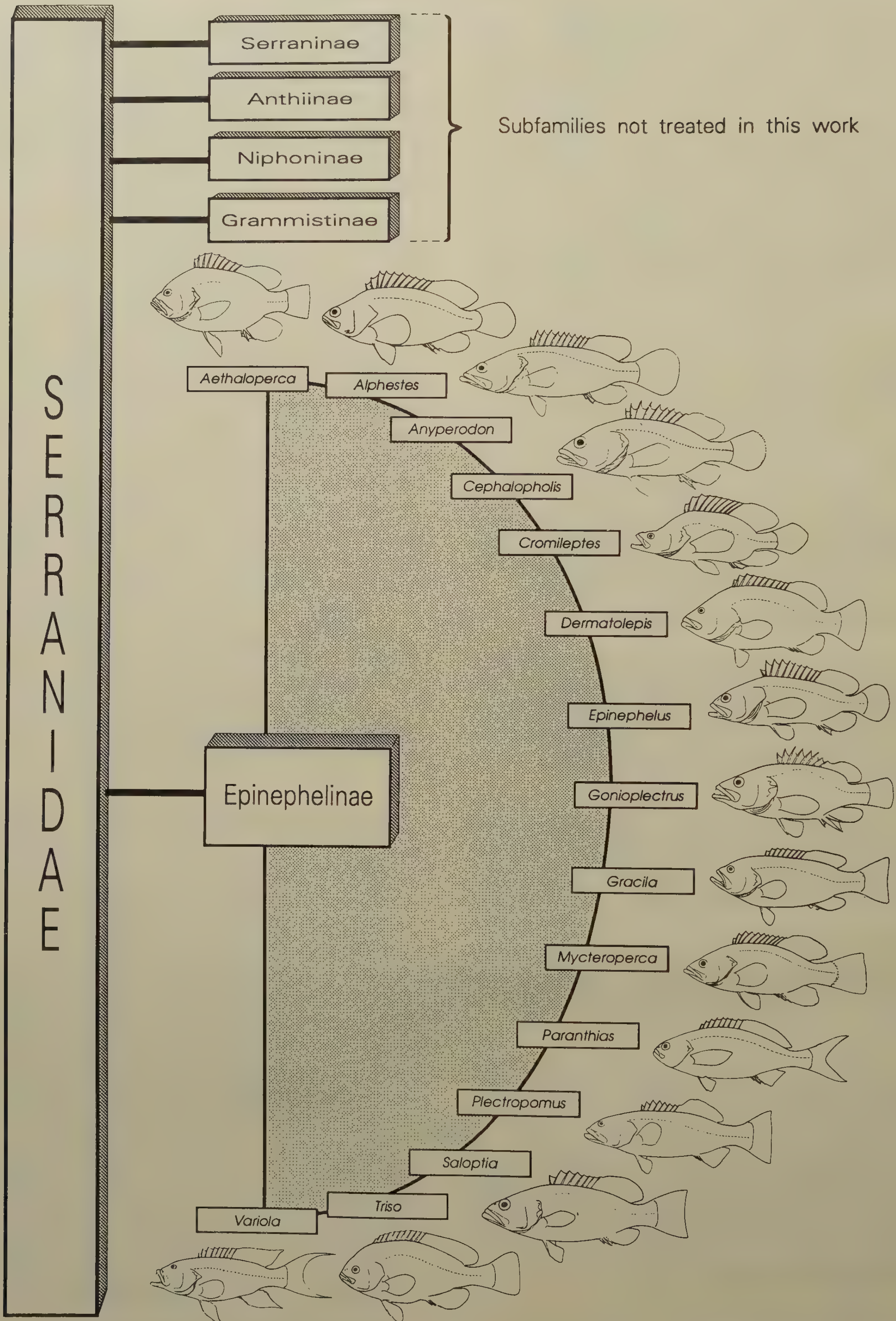
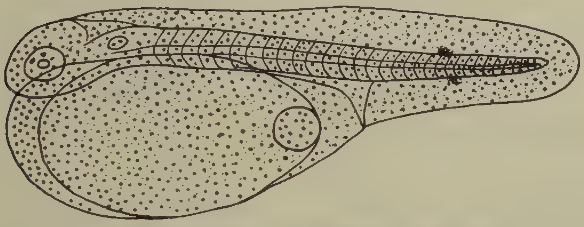

SERRANIDAE
Serraninae
Anthiinae
Niphoninae
Grammistinae
Subfamilies not treated in this work
Epinephelinae
Aethaloperca
Alphestes
Anyperodon
Cephalopholis
Cromileptes
Dermatolepis
Epinephelus
Gonioplectrus
Gracila
Mycteroperca
Paranthias
Plectropomus
Saloptia
Triso
Variola

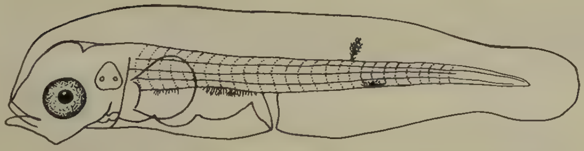
Fig. 1 Classification of the Family Serranidae

duct. In a mature female, numerous oocytes are arrayed in lamellae surrounding a central lumen, with spermatogenic tissue in small dormant crypts on the periphery of the lamellae. After spawning as a female for one or more years, the grouper changes sex and thereafter functions as a male. At sexual transition, the oocytes degenerate, the spermatogonia proliferate, and the ovary is transformed into a functional testis. Evidence of the ovarian origin of the testes are the remnants of oocytes and the ovarian lumen, which can be seen in cross-sections of the testes. This protogynous mode of reproduction is complicated in certain species by the occurrence of some large females that do not change sex and some small males that are mature at the same size as the smallest females. An exogenous (behavioural) inducement of sexual transformation, as opposed to an endogeneous (size) threshold, is indicated by 1) the sexual transition occurring over a broad range of size (age), and 2) the presence of females older than the age at which transition is completed for the population.

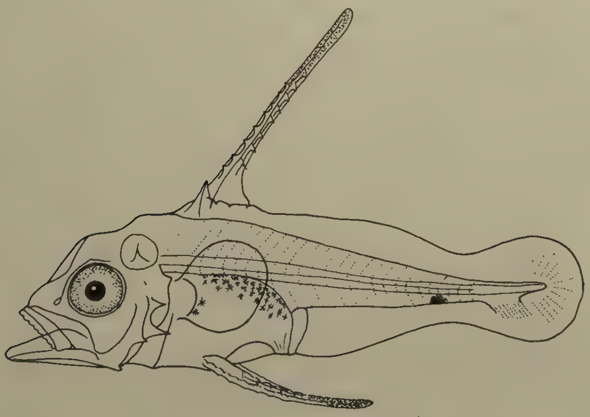
The available information on the larval development of some 29 species of groupers was summarized by Kendall (1984) and Leis (1987). The fertilized eggs are pelagic, spherical, transparent, 0.70 to 1.20 mm in diameter, with a smooth chorion, colourless unsegmented yolk and a single colourless oil globule 0.13 to 0.22 mm in diameter. Newly hatched larvae of *E. septemfasciatus* (Fig. 2) are 1.85 mm TL, and first feeding begins on the third day after hatching (2.6 mm TL). Grouper larvae are characterized by their "kite-shaped" body (greatest body depth at origin of dorsal fin), second dorsal-fin spine and pelvic-fin spines greatly elongated, with 3 or 4 serrate longitudinal ridges, well-developed head spination (with prominent spines on the preopercle and supraocular ridge), and dense pigmentation on the dorsolateral surface of the body cavity. In laboratory reared specimens, the pelagic larvae of *E. akaara* transformed to the benthic juvenile stage at 25 mm TL, 25 or 26 days after hatching (Mito et al., 1967). But in *E. septemfasciatus*, the transformation occurred at 31 mm TL, and the pelagic larval period lasted 60 days (Kitajima et al., 1991). In view of the shallow water bottom-associated habitat of adults and juveniles, the relatively long-lived pelagic larvae of groupers may provide the mechanism by which many species have attained their wide geographic distributions.



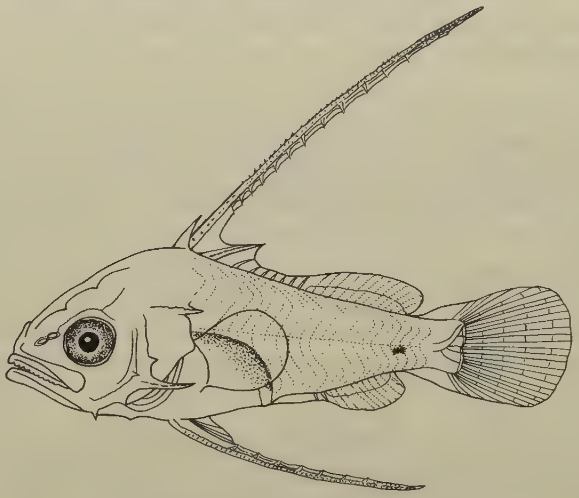
newly hatched larva, 1.85 mm total length



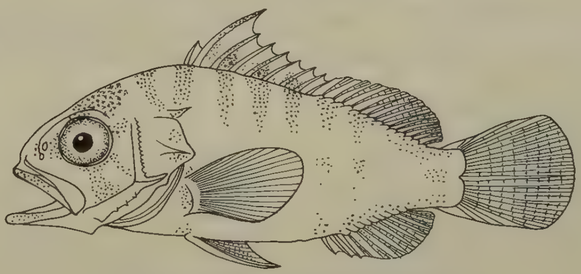
postlarva, 3-day old, 2.60 mm total length



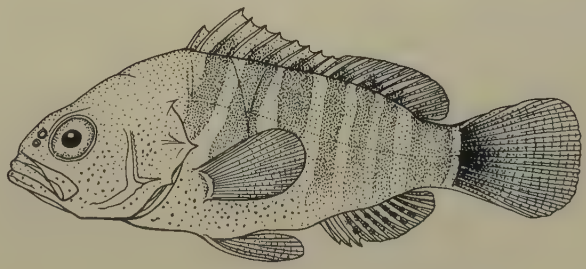
25-day old, 4.8 mm total length



33-day old, 8.1 mm total length



60-day old, 30.8 mm total length



75-day old, 49.3 mm total length

Fig. 2 Larval Development stages of *Epinephelus septemfasciatus* (after Kitajima et al., 1991)

1.2 Fisheries

Groupers are of considerable importance in the commercial, sport, and artisanal fisheries of tropical and subtropical seas. A few species are used in aquaculture. *Epinephelus coioides, E. malabaricus, E. akaara, E. striatus, E. septemfasciatus, Cromileptes altivelis*, and *Mycteroperca microlepis* have been spawned in captivity. Several species are commonly used in cage-culture operations.

The protogynous mode of reproduction in groupers presents problems for fishery management. Male groupers (which are produced by sexual transformation of old females) are usually larger, older and less numerous than females; and the commercial, sport and subsistence fisheries are often biased (by means of hook size and fishing techniques) towards the capture of large adults. Hence, males are caught in greater proportion than they exist in local populations. The reproductive consequences of this sexually selective fishing may differ from the consequences of non-selective fishing in gonochoristic species. Bannerot et al. (1987) discuss the problems inherent in stock assessment and management of grouper fisheries.

Groupers contribute substantially to the world commercial fish catch, with over 97 000 t landed in 1990 (Table 1). In addition, these statistics greatly underestimate the total catch, because most groupers are caught in artisanal fisheries, which do not report catch statistics. This under-reporting of grouper catches is indicated by the fact that, despite the much greater size and reef area of the Indo-Pacific region, more groupers are reported in commercial fisheries statistics from the Atlantic Ocean than from the Indian and Pacific oceans combined. The largest commercial catch of groupers is reported from the Caribbean area (Table 2, FAO Fishing Area 31).

From 1981 to 1990 there has been a trend of increasing landings of groupers (Table 3). This is generally true for all species or categories reported, except for *Epinephelus morio* from the Gulf of Mexico which appears to be in decline.

1.3 Classification of the Family Serranidae

The composition and phylogenetic relationships of the Family Serranidae were discussed by Johnson (1983, 1988), Kendall (1984), and Leis (1986). Johnson (1983) proposed that the Serranidae comprises three subfamilies: Serraninae, Anthiinae and Epinephelinae. He further divides the Epinephelinae into 5 tribes: Niphonini, Epinephelini, Diploprionini, Liopropomini, and Grammistini. Johnson (1988) hypothesized that the Diploprionini, Liopropomini, and Grammistini constitute a monophyletic group that is most closely related to the Epinephelini, and that this group of four tribes is the sister taxon on the Niphonini. An alternative classification that does not contradict the phylogenetic relationships proposed by Johnson is adopted here. In our scheme the Family Serranidae is divided into five subfamilies: Serraninae, Anthiinae, Niphoninae, Epinephelinae, and Grammistinae (Fig. 1). The Grammistinae includes the tribes Grammistini, Diploprionini, and Liopropomini.

Table 1
Reported world catch of groupers in metric tons by area in 1990 (FAO, 1992)

Species	**Main Areas**				
	Pacific Ocean	**Atlantic Ocean**	**Mediterranean and Black Sea**	**Indian Ocean**	**Total**
E. aeneus		2 169 F	414 F		2 583 F
E. akaara	166				166
E. analogus	18				18
*E. marginatus**		1 261 F	3 308 F		4 569 F
E. morio		2 964 F			2 964 F
E. striatus		201			201
E. tauvina	199				199
Epinephelus spp.**	21 786 F	43 241 F	3 547 F	16 767 F	85 341 F
Mycteroperca spp.		1 100 F			1 100 F
Total	22 169 F	50 936 F	7 269 F	16 767 F	97 141 F

* catches for *E. marginatus* were previously reported as *E. guaza*
** not elsewhere included
F = FAO estimate from available sources of information

Table 2
Reported world catch of groupers in metric tons by FAO Fishing Areas in 1990 (FAO, 1992)

Species	**FAO Fishing Areas**											
	27	**31**	**34**	**37**	**41**	**47**	**51**	**57**	**61**	**71**	**77**	**87**
E. aeneus			2 169F	414F								
E. akaara									166			
E. analogus												18
*E. marginatus**	194		1 067F	3 308F								
E. morio		1 164			1 800F							
E. striatus		201										
E. tauvina									199			
Epinephelus spp.**		28 140F	12 240F	3 547F	2 566F	295	12 717F	4 050	5 386	15 102F	886 F	412
Mycteroperca spp.					1 100F							
Total	194	29 505F	15 476F	7 269F	5 466F	295	12 717F	4 050F	5 757F	15 102F	886F	430

Table 3
Reported world catch of groupers in metric tons for the years 1981 to 1990 (FAO, 1992)

Species (Area reported)	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
E. aeneus (Mediterranean and Atlantic)	1 000	889F	960 F	1 729F	1 621F	1 181	1 289F	2 679	2 596F	2 583F
E. akaara (Hong Kong)					135	210	401	164	150	166
E. analogus (Colombia)	50	10	3	40	33	58	58	25	24	18
*E. marginatus** (Mediterranean and Atlantic)	1 796	1 443	1 939	4 098	4 320	3 748	3 799	3 946	4 346F	4 569F
E. morio (Cuba, Mexico, Brazil)	13 226	11 598	3 535	3 611	3 791	3 748	4 170	4 019F	4 456F	2 964F
E. striatus (Colombia and Cuba)	391	414	398	370	491	361	363	287	305	201
E. tauvina (Hong Kong)					108	126	353	246	160	199
Epinephelus spp. ** (all areas)	51428F	57599F	51 150F	62 510F	62 056F	63 682F	66 124F	76 850F	75 862F	85 341F
Mycteroperca spp. (Brazil)	884	793	984	942	2 117	1 126	1 228	1 073F	1 100F	1 100F
Total	68 775F	72 746 F	58 969F	73 300F	74 672F	74 240F	77 785F	89 289F	88 999F	97 141F

* catches for *E. marginatus* were previously reported as *E. guaza*
** not elsewhere included
F = FAO estimate from available sources of information

1.4 Illustrated Glossary of Technical Terms and Measurements

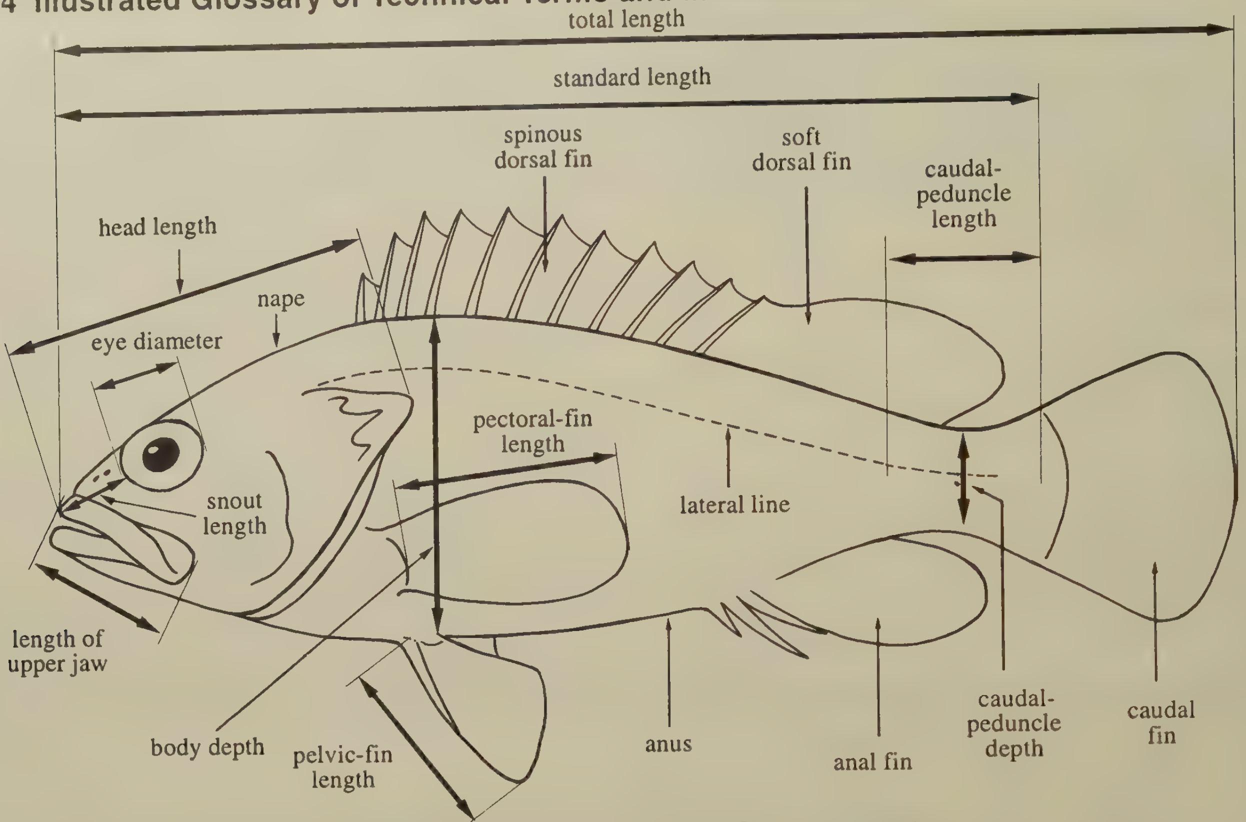

total length
standard length
spinous dorsal fin
soft dorsal fin
caudal-peduncle length
head length
nape
eye diameter
pectoral-fin length
lateral line
snout length
length of upper jaw
body depth
pelvic-fin length
anus
anal fin
caudal-peduncle depth
caudal fin

Fig. 3 External morphology and measurements

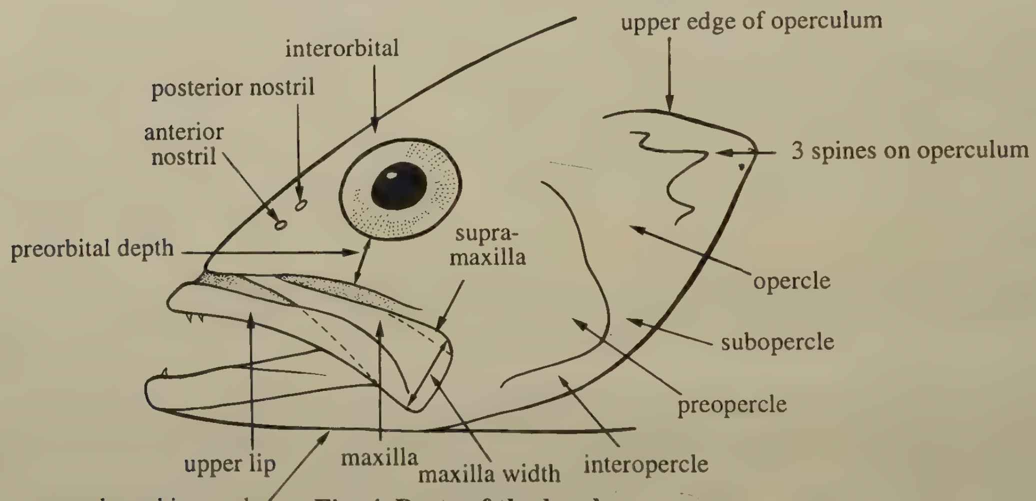

upper edge of operculum
interorbital
posterior nostril
anterior nostril
3 spines on operculum
preorbital depth
supra-maxilla
opercle
subopercle
preopercle
upper lip
maxilla
maxilla width
interopercle
branchiostegals

Fig. 4 Parts of the head

Anterior - Towards the head or front end of the fish.

Antrorse - Curved or pointing anteriorly.

Axil - The inner side of the base of the pectoral or pelvic fins.

Band - An elongate colour marking, approximately 1 or 2 eye diameters in width (Fig. 5).

Bar - An elongate colour mark with vertical or near vertical orientation (Fig. 5).

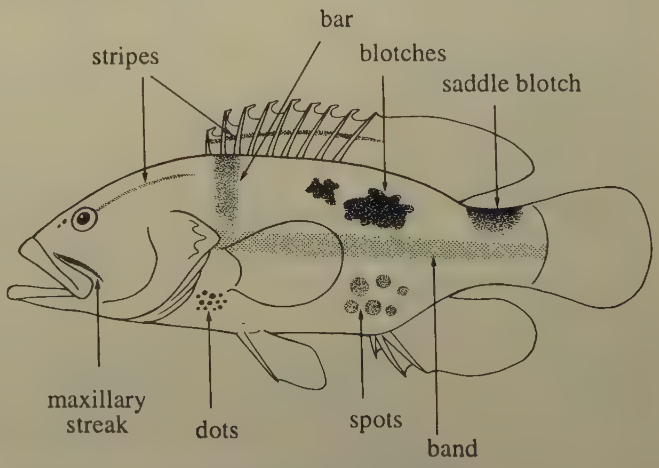

bar
stripes
blotches
saddle blotch
maxillary streak
dots
spots
band

Fig. 5 Colour markings

Belly - The lower part of the body from the pelvic fins to the anal fin.

Blotch - A colour mark, larger than the eye and usually with irregular or indistinct borders (Fig. 5).

Body width - The greatest width (thickness) of the body, usually occurring at the base of the pectoral fins.

Branchiostegals - Ray-like bones supporting the gill membrane that seals the underside of the gill cavity (Fig. 4).

Canine - A prominent, conical tooth (sometimes curved) that is distinctly larger than other teeth in the jaws.

Caudal fin - The tail fin (Fig. 3). The shape of the caudal fin is distinctive for many species of groupers (Fig. 6). The **caudal-fin length** is the length of the longest caudal-fin rays.

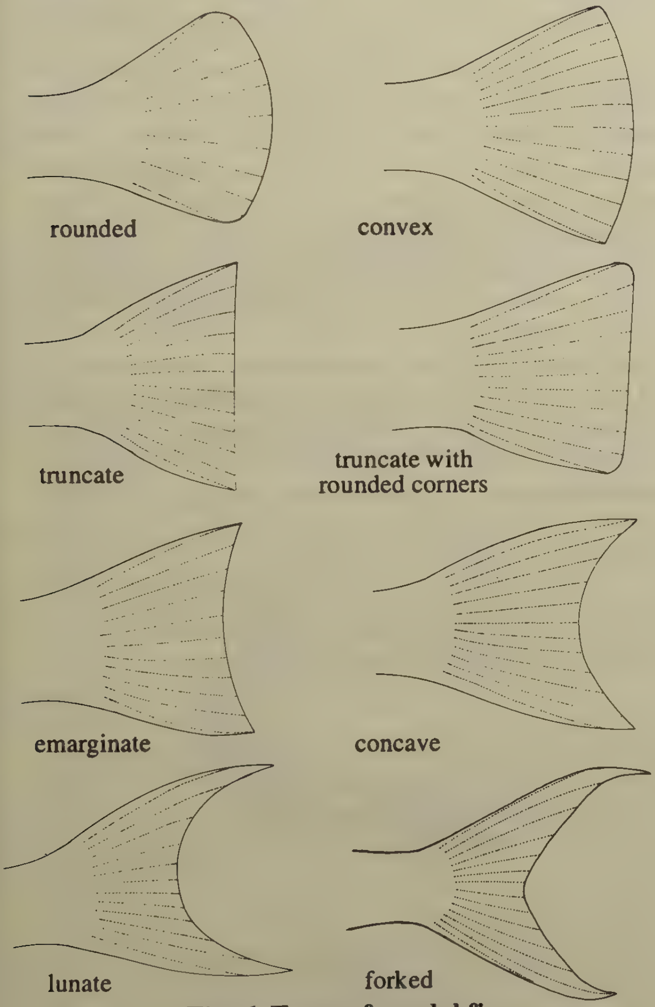

rounded
convex
truncate
truncate with rounded corners
emarginate
concave
lunate
forked

Fig. 6 Types of caudal fins

Caudal peduncle - The part of the tail that joins the caudal fin to the body. The **caudal-peduncle length** is the horizontal distance from the rear end of the anal fin base to a vertical at the caudal-fin base (Fig. 3). The **caudal- peduncle depth** is the least depth of the peduncle (Fig. 3).

Caudal vertebrae - Vertebrae that bear a haemal spine ventral to the vertebral centrum (Figs 7 and 8).

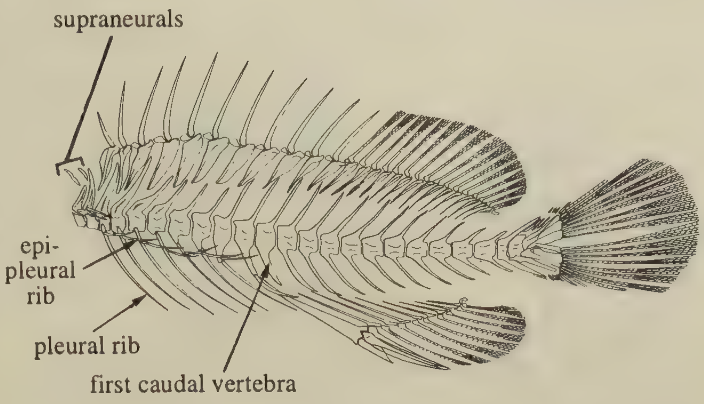

supraneurals
epi-
pleural
rib
pleural rib
first caudal vertebra

Fig. 7 Axial skeleton of *Epinephelus fasciatus*

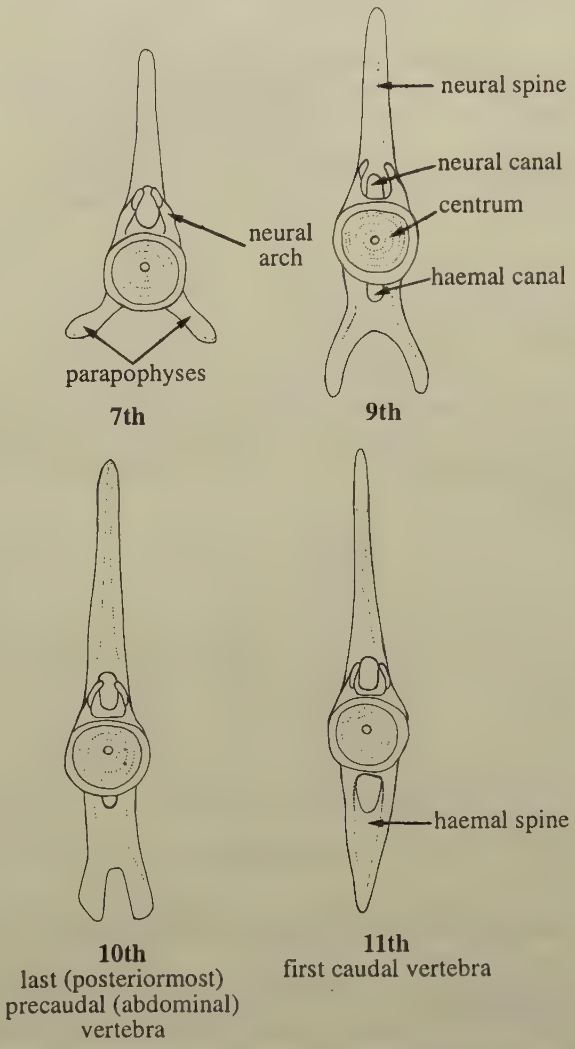

neural spine
neural canal
centrum
haemal canal
neural arch
parapophyses
7th
9th
haemal spine
10th
last (posteriormost) precaudal (abdominal) vertebra
11th
first caudal vertebra

Fig. 8 Anterior view of vertebrae.

Compressed - Laterally flattened. A compressed fish (e.g., *Anyperodon)* has the body width less than half of the body depth.

Cranium - Bony part of the head, enclosing the brain; the skull. It is composed of many different bones (Fig. 9).

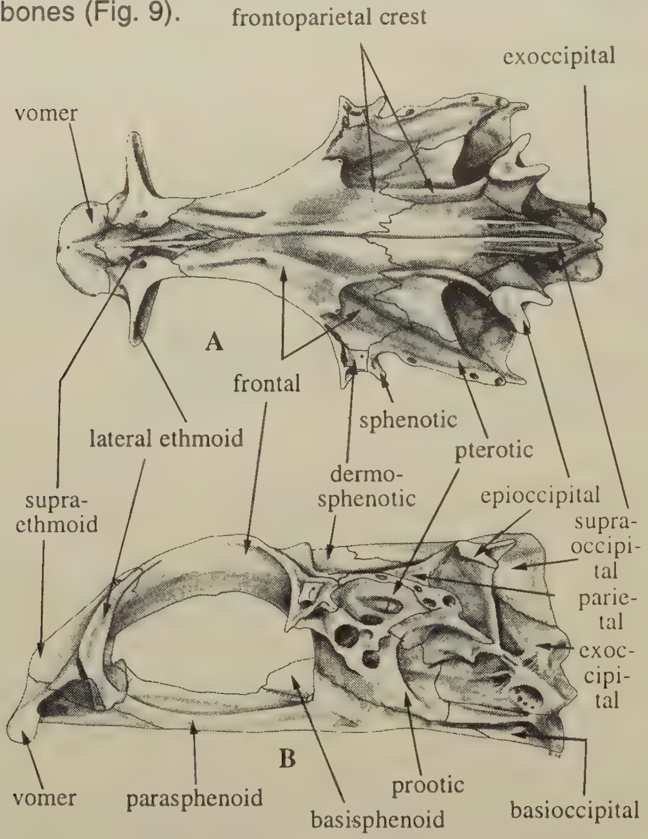

frontoparietal crest
exoccipital
vomer
A
frontal
lateral ethmoid
sphenotic
pterotic
dermo-sphenotic
epioccipital
supra-ethmoid
supra-occipital
parietal
exoccipital
B
vomer
parasphenoid
prootic
basisphenoid
basioccipital

Fig. 9 Dorsal (A) and lateral (B) views of the cranium of *Epinephelus fasciatus*

Ctenoid scale - A scale with minute spines (ctenii) along the posterior margin. Ctenoid scales feel rough when the fish is stroked towards the head (Fig. 10).

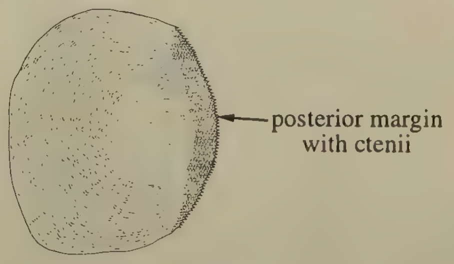

posterior margin with ctenii

Fig. 10 Ctenoid scale

Distal - Away from the centre of the body or base of a fin.

Dorsal - On or towards the upper part of the fish.

Dorsal fin - The median fin on the upper part of the body (Fig. 3).

Dot - A colour mark about the size of a nostrils (Fig. 5).

Emarginate - Slightly concave (Fig. 6).

Epipleural ribs - Bones that attach on outside of upper surface of ribs (Fig. 7).

Eye diameter - The horizontal diameter of the fleshy orbit (eye opening) (Fig. 3).

Gill arch - One of the 4 arches of bones that bear the gills. If the gill cover or operculum (Fig. 4) is lifted, the (outermost) gill arch is visible in the gill cavity (Fig. 11).

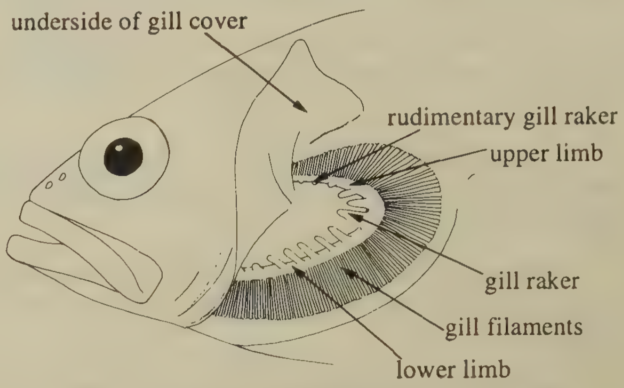

underside of gill cover
rudimentary gill raker
upper limb
gill raker
gill filaments
lower limb

Fig. 11 First gill arch

Gill filaments - The soft, bright red filaments attached along the posterior (outer) edge of the gill arches (Fig. 11).

Gill rakers - The long bony protuberances along the anterior (inner) edge of the gill arches (Fig. 11). The **gill-raker count** is often given as two numbers (X + Y), where X is the number of rakers on the **upper (dorsal) limb** of the first arch, and Y is the number of rakers on the **lower (ventral) limb**, with the raker at the angle (junction of upper and lower limbs) included in the lower-limb count. The range in number of gill rakers for a species is often given as follows: 7-9 + 16-19 (which means there are 7 to 9 rakers on the upper limb and 16 to 19 rakers on the lower limb. **Rudimentary rakers** or **rudiments** (Fig. 12) are wider than long (high) and (unless indicated otherwise) are usually included in the gill-raker counts. If the rudiments are difficult to distinguish from intercalated bony tooth plates, the gill-raker count is of "developed" rakers only.

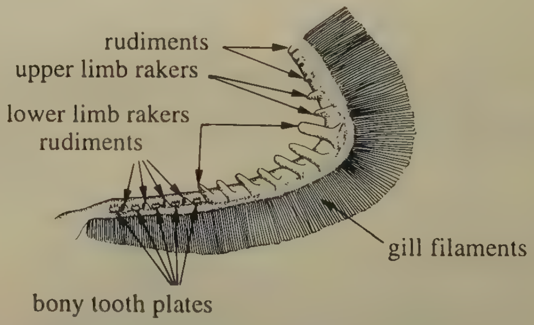

rudiments
upper limb rakers
lower limb rakers
rudiments
gill filaments
bony tooth plates

Fig. 12 Gill rakers and rudiments

Head length - The straight-line measurement from the front of the upper lip at the midline (with upper jaw retracted) to the posteriormost point of the operculum (Fig. 3).

Interorbital width - The least distance between the fleshy edges of the orbits (Fig. 4).

Lateral - Of or towards the side; opposite of "medial".

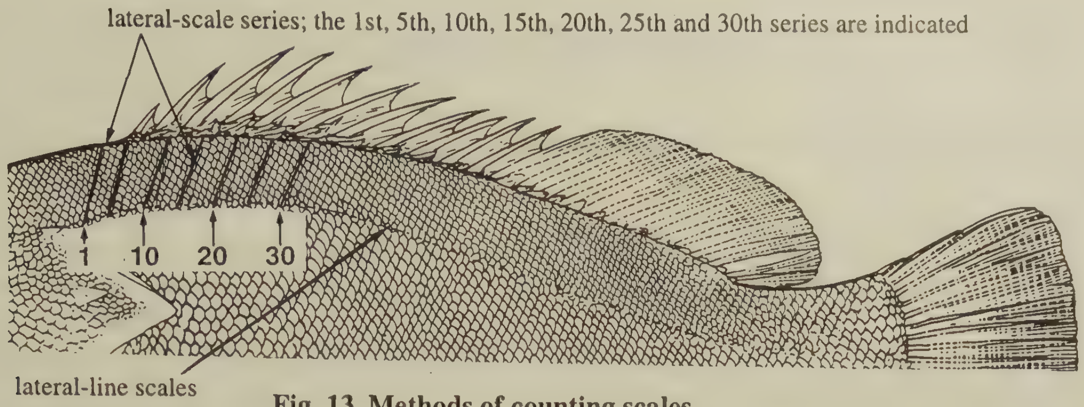

lateral-scale series; the 1st, 5th, 10th, 15th, 20th, 25th and 30th series are indicated
1
10
20
30
lateral-line scales

Fig. 13 Methods of counting scales

Lateral line - The series of pored or tubed scales that run from the upper end of the gill cavity to the caudal fin (Figs 3 and 13).

Lateral-scale series - The oblique series of scales that run above the lateral line from the upper end of the gill opening to the base of the caudal fin (Fig. 13).

Lunate - Shaped like a crescent moon; deeply concave (Fig. 6).

Maxilla - The posterior, toothless bone of the upper jaw; partly covered by the upper lip when the mouth is closed (Fig. 4).

Maxillary streak - A dark streak along the edge of the maxillary groove (the groove below the eye that is hidden by the maxilla when the mouth is closed) (Fig. 5). Also called **moustache streak**.

Medial - Towards the middle or median plane of the body; opposite of "lateral."

Median fins - The dorsal, anal and caudal fins.

Nape - The posterior part of the top of the head (Fig. 3).

Opercle - The largest bone of the operculum (gill cover); mostly covered by skin and scales (Fig. 4).

Orbit - The fleshy eye opening. In live fish, the transparent cornea of the eye protrudes slightly through the orbit.

Palatines - The paired bones on each side of the roof of the mouth immediately posterior to the vomer. In most groupers, the palatines bear minute teeth which are visible on the roof of the mouth (Fig. 14).

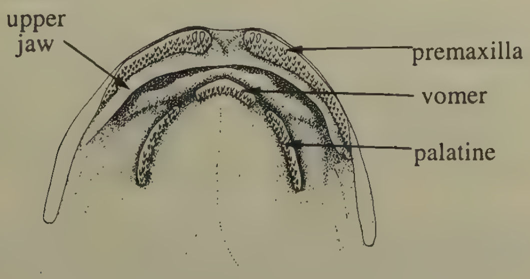

upper jaw
premaxilla
vomer
palatine

Fig. 14 Upper jaw and palate

Precaudal vertebrae - The anterior vertebrae which lack a haemal spine, but bear pleural ribs (Figs 7 and 8).

Premaxilla - The paired, tooth-bearing bones of the upper jaw, mostly hidden by the upper lip (Fig.14).

Preopercle - The rounded or angular bone on the front part of the operculum; the posterior edge is exposed and usually serrate (Fig. 4).

Preorbital - The anteriormost and largest bone of the circumorbital bones that form the lower edge of the orbit (Fig. 4).

Pterygiophore - The series of 2 or 3 bones that support each of the spines and rays of the dorsal and anal fins (Fig. 15). Note that the distal element of each pterygiophore is between the left and right halves of its associated (following) fin ray.

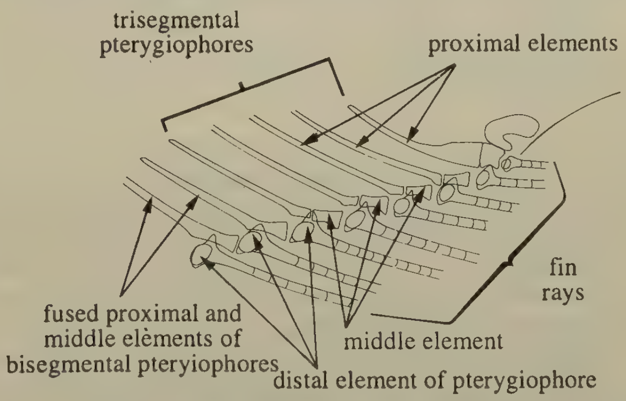

trisegmental pterygiophores
proximal elements
fin rays
fused proximal and middle elements of bisegmental pteryiophores
middle element
distal element of pterygiophore

Fig. 15 Pterygiophores of the anal fin

Rays - The rigid or flexible struts that support the fins. **Soft rays** (usually just called "rays") are segmented, flexible and usually branched; the rays are also bilaterally paired (this bilateral structure is evident if the fish is cooked). **Spinous rays** (or fin "spines") are unsegmented, simple (unbranched) and pungent (stiff and sharp pointed). In the ichthyological literature, the fin spines are usually designated by Roman numerals and the soft-rays by Arabic numerals: D IX,14 (meaning that the dorsal fin has IX spines and 14 rays). The last ray of the dorsal and anal fins of groupers is usually split to its base and looks like two rays, but it is counted as a single ray because it is supported by a single pterygiophore.

Saddle blotch - A dark saddle-shaped blotch on the dorsal part of the body or caudal peduncle (Fig. 5).

Serrate - With a series of small points (serrae) like the teeth of a saw.

Snout - The part of the head in front of the eye (Fig. 3).

Spine - A sharp and stiff projection (see also rays).

Spot - A colour mark which is eye-sized or smaller, but larger than the size of the nostrils and usually with a regular or distinct margin (Fig. 5).

Standard length - The straight line distance from the tip of the snout to a vertical line passing through the base of the caudal fin (taken to be the point of flexure of the caudal fin) (Fig. 3).

Stripe - A narrow, oblique or horizontal colour marking, less than an eye diameter in width (Fig. 5).

Supramaxilla - A small elongate bone lying along the dorsal edge of the maxilla (Fig. 4).

Supraneural bones - Unpaired bones above the neural spines of anterior vertebrae between skull and origin of dorsal fin (Fig. 7). Also referred to as **predorsal bones**.

Synonym - An alternate name given to a particular species, genus, family etc. The oldest (senior) synonym that is given to a species is usually considered the valid (correct) scientific name for that species.

Thoracic - Pertaining to the thorax or chest region below the pectoral-fin base and in front of the pelvic fins.

Total length - The straight-line distance from the tip of the anteriormost jaw to a vertical line passing through the posterior tip of the longest caudal-fin ray (Fig. 3).

Truncate - Cut square; a caudal fin with a straight rear margin (Fig. 6).

Ventral - On or towards the lower part (underside) of fish.

Vertebrae - Bones of axial skeleton; divided into 2 sections, precaudal (abdominal) and caudal vertebrae (Figs 7 and 8).

Vomer - A median bone which lies on the roof of the mouth; often bears teeth (Figs 9 and 14).

1.5 Plan of the Catalogue

A classification of the Family Serranidae and a diagnosis of the Subfamily Epinephelinae are given, followed by remarks on the classification of groupers (Subfamily Epinephelinae), glossary of technical terms and measurements, aids to identification of groupers (keys to genera and species), and the information by genus and species (arranged alphabetically by genus and species). Since most species occur in only a single major region, the keys to species of the largest genera (*Cephalopholis*, *Mycteroperca* and *Epinephelus*) are divided into regional keys to shorten them and make them easier to use. Each genus account includes the type species and generic synonyms. For genera with more than one species, we also include a diagnosis and general comments on the habitat, biology, distribution and interest to fisheries of the included species. The information pertaining to species is divided into the following sections:

(1) **Scientific Name**: The reference to the original description and type locality of the species is given.

(2) **Synonyms**: Primary synonyms and alternate combinations of generic and specific names are listed.

(3) **FAO Name**: The FAO English name is considered the standard to be used for fishery purposes. This should avoid confusion caused by the existence of multiple names for the same species or the same name for several species. The FAO name is not intended to supplant the use of local names, but rather to serve as a worldwide reference. FAO French and Spanish names are given for each species.

(4) **Diagnostic Features**: Distinctive characters of the species are given as an aid for identification. These diagnoses should be consulted to confirm species identified using the illustrated key.

(5) **Geographical Distribution**: The general geographic range is given and illustrated on a map. The map shading includes known areas of occurrence and intermediate areas where a species is expected to be found.

(6) **Habitat and Biology**: Information on habitat, feeding preferences, age and growth, reproduction and behaviour is given for many species.

(7) **Size**: The maximum known size for each species is given.

(8) **Interest to Fisheries**: General information on the extent, type of fisheries and utilization is given. Detailed catch statistics (landings) are not available for all individual species.

(9) **Local Names**: Published local names are given. A local name is often applied to several species.

(10) **Literature**: Recent references that contain important information are given.

(11) **Remarks:** Taxonomic details and information that is not appropriate in the previous paragraphs are included here.

2. SYSTEMATIC CATALOGUE

2.1 Diagnostic Features of the Subfamily Epinephelinae

FAO Names: En - Groupers, Hinds, Coralgroupers, Lyretails, Creole-fishes, Mutton hamlets, Spanish flag, Leather bass; **Fr** - Mérous, Vielles, Vareches, Pavillion, Badèches, Croissant queues; **Sp** - Meros, Chernas, Guasetas, Bandera, Cunas, Indio.

Diagnostic Features: Body robust or somewhat compressed, oblong-oval to rather elongate. Mouth with small, slender, depressible teeth on jaws, vomer and palatines (***Anyperodon*** lacks palatine teeth); distinct canine teeth present at front of mouth in some species; no molars or incisiform teeth; maxilla exposed when mouth is closed; supramaxilla well developed (rudimentary or absent in ***Paranthias***). A single dorsal fin with VII to XI spines and 10 to 21 rays; anal fin with III spines (inconspicuous in ***Plectropomus***) and 7 to 13 rays (the last dorsal- and anal-fin rays usually split to their base but counted as a single ray); caudal fin with 13 to 15 branched rays; pelvic fins with I spine and 5 branched rays; pelvic-fin insertion under or a little behind pectoral-fin base; no scaly process (axillary scale) at base of pelvic fins. Edge of preopercle serrate (serrae reduced in adult ***Cephalopholis*** and ***Plectropomus***; opercle with 3 flat spines (upper and lowermost spines often covered by skin and scales); upper edge of operculum free; gill membranes separate, joined to isthmus far forward, with 7 branchiostegal rays. Anterior and posterior nostrils close together. Lateral line single. Scales small, more than 78 oblique series from upper end of gill opening to caudal-fin base; lateral-line scales separated, inconspicuous, smaller than surrounding scales and mostly covered by them; soft dorsal, anal and caudal fins scaly. Vertebrae 10 precaudal and 14 caudal; first dorsal-fin pterygiophore with one supernumerary fin spine and no separate distal element; supraneural bones 2 (1 in ***Plectropomus*** and ***Saloptia***).

Larva with second dorsal-fin spine and pelvic-fin spines greatly elongate and serrate, a long serrate spine at the angle of the preopercle, and a large melanophore on the caudal peduncle that migrates from the ventral midline to a midlateral position early in development (Fig. 2).

The Subfamily Epinephelinae, as here constituted, comprises 15 genera: ***Aethaloperca, Alphestes, Anyperodon, Cephalopholis, Cromileptes, Dermatolepis, Epinephelus, Gonioplectrus, Gracila, Mycteroperca, Paranthias, Plectropomus, Saloptia, Triso,*** and ***Variola***.

2.2 Notes on the Identification of Groupers

Grouper species are identified by their colour pattern and (or) a suite of morphological characters including body shape (Fig. 3), configuration and size of the fins, the shape and relative size of the head and various parts of the head and body; and the number of fin rays, scales and gill rakers. Except in large adults of some species, the colour pattern of most groupers is usually distinctive enough to identify the particular species. But one needs to be aware of the intraspecific variation in colour pattern for each species. Juveniles of some species look completely different from adults of the same species. In species with dark spots, the spots become smaller and more numerous with growth. And the colour pattern can often be altered in a few seconds, depending on the mood of the fish. Many groupers have a "fright" or "stress" pattern of white blotches or bars. Groupers from deep water are usually more reddish than fish of the same species that are caught in shallow water. A few species (e.g. ***Mycteroperca rosacea***) have a xanthic colour morph that is bright yellow or orange-yellow. Post-mortem changes in colour pattern can obscure the normal pattern of the live fish. The skin is usually blanched if a fish is in contact with the ground during or immediately after death.

Fin counts are usually done with a bright light shining through the fin, and the count of pectoral-fin rays on those species with fleshy fins is usually easier to do on the inner (medial) side of the fin. The last dorsal- and anal-fin rays are split to their base but counted as a single ray.

Lateral-line scale counts are facilitated with the fish lying on its right side with its head pointing left, a bright light directed at a low angle to the body surface. A jet of compressed air that can be directed through a large hypodermic needle onto the lateral line is also useful.

2.3 Illustrated Key to the Genera of Groupers

1a. Dorsal-fin spines VII to VIII; lower edge of preopercle with 1 to 3 enlarged spines pointing anteroventrally (these spines are usually hidden by skin and scales, but they can easily be detected by running a finger or probe along the preopercle edge; see Figs 16 and 17) . . . . . → *2*

1b. Dorsal-fin spines IX to XI; lower edge of preopercle smooth (except for species of ***Alphestes***, which have a large spine at the angle, and a few species of ***Epinephelus*** with 1 to 4 small spines on the lower edge of preopercle) . . . . → *4*

2a. Body depth 2.3 to 2.5 times in standard length; lateral-line scales 47 to 49; branched caudal-fin rays 15 (Fig. 17) (western Atlantic) . . . . *Gonioplectrus*

2b. Body depth 2.6 to 3.9 times in standard length; lateral-line scales 70 to 115; branched caudal-fin rays 13 (Indo-Pacific) . . . . → *3*

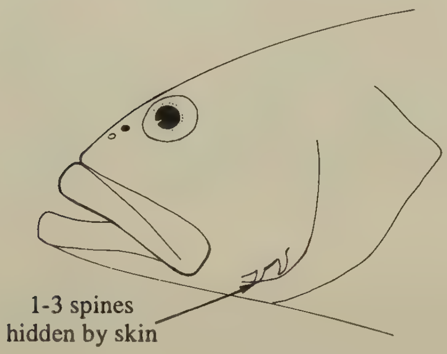

1-3 spines
hidden by skin

Fig. 16

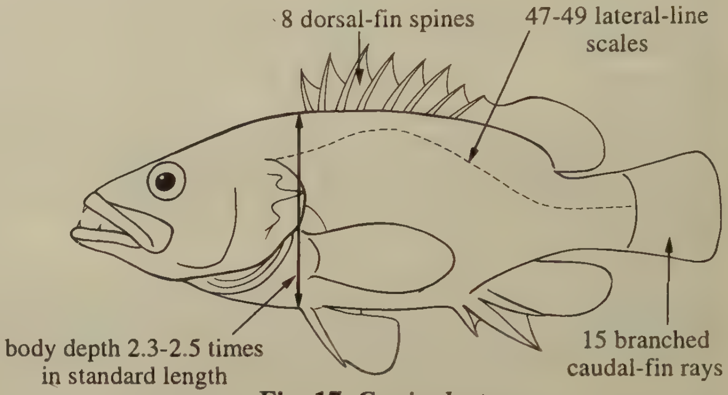

8 dorsal-fin spines
47-49 lateral-line scales
body depth 2.3-2.5 times in standard length
15 branched caudal-fin rays

Fig. 17 ***Gonioplectrus***

3a. Anal-fin spines strong, all III distinct; preorbital depth 0.2 to 0.5 times orbit diameter; head length 2.5 to 2.6 times in standard length (Fig. 18) (western and central Pacific Ocean) . . . *Saloptia*

3b. Anal-fin spines weak, not apparent without dissection; preorbital depth (of fish 20 to 100 cm standard length) 0.7 to 2.0 times orbit diameter; head length 2.8 to 3.1 times in standard length (Fig. 19) (Indo-Pacific). . . . . *Plectropomus*

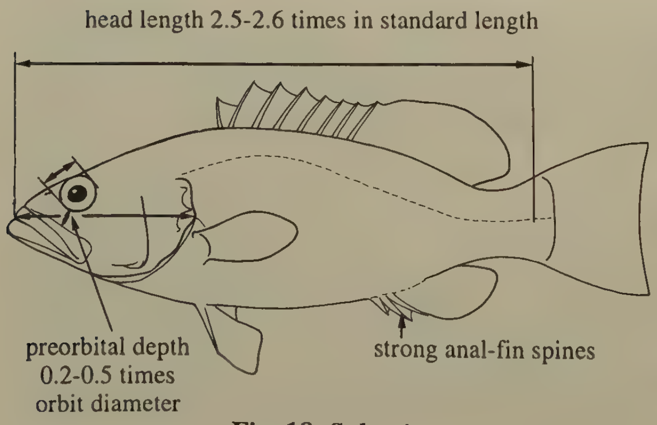

head length 2.5-2.6 times in standard length
preorbital depth 0.2-0.5 times orbit diameter
strong anal-fin spines

Fig. 18 ***Saloptia***

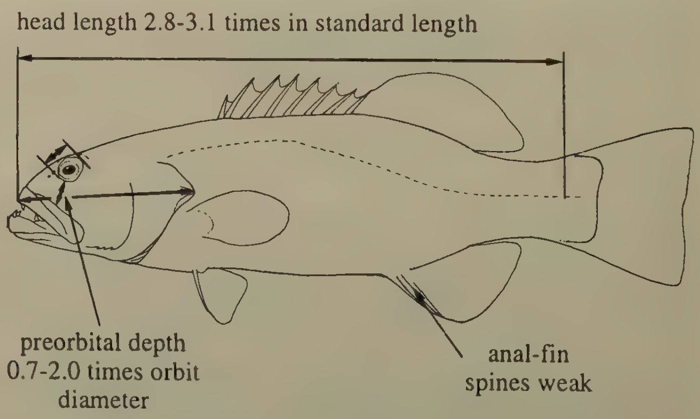

head length 2.8-3.1 times in standard length
preorbital depth 0.7-2.0 times orbit diameter
anal-fin spines weak

Fig. 19 ***Plectropomus***

4a. Caudal fin deeply lunate or forked; dorsal-fin spines IX . . . . → *5*

4b. Caudal fin rounded, truncate or concave; dorsal-fin spines IX to XI . . . . → *6*

5a. Head small, its length 3.3 to 4.0 times in standard length; dorsal fin with IX spines and 17 to 21 rays (Fig. 20) (Atlantic and eastern Pacific oceans) . . . . *Paranthias*

5b. Head length 2.5 to 2.8 times in standard length; dorsal fin with IX spines and 13 or 14 rays (Fig. 21) (Indo-Pacific) . . . . *Variola*

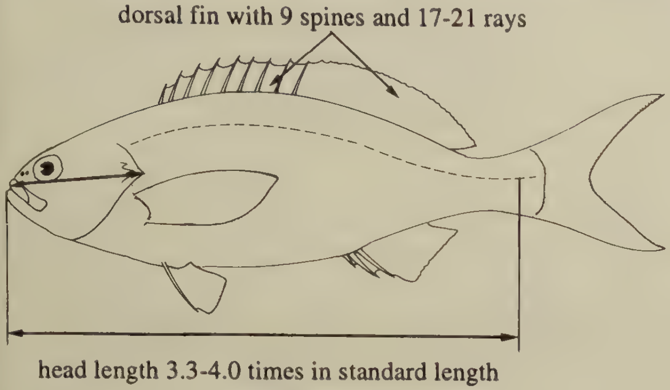

dorsal fin with 9 spines and 17-21 rays
head length 3.3-4.0 times in standard length

Fig. 20 ***Paranthias***

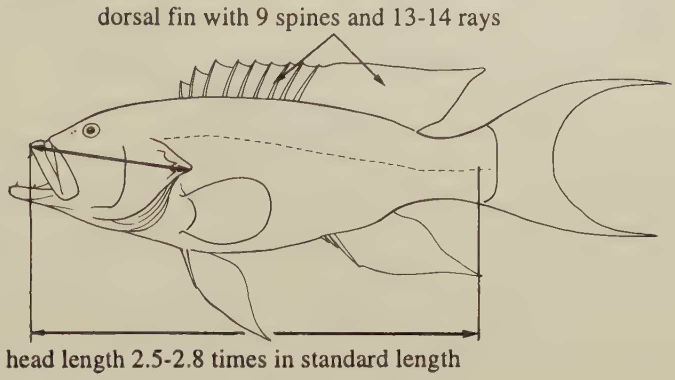

dorsal fin with 9 spines and 13-14 rays
head length 2.5-2.8 times in standard length

Fig. 21 ***Variola***

6a. No teeth on palatines; head and body elongate and markedly compressed, the body width 11 to 15% of standard length and contained 3 to 4 times in head length (Fig. 22) (Indo-Pacific) . *Anyperodon*

6b. Palatines with teeth; body compressed in some species, but its width contained less than 3 times in head length . . . . → *7*

7a. Dorsal profile of head markedly concave; dorsal-fin spines X; rear nostrils in adults a long vertical slit (Fig. 23) (Pacific and eastern Indian Ocean) . . . . *Cromileptes*

7b. Dorsal profile of head straight, convex or slightly concave; dorsal-fin spines IX or XI (rarely X); rear nostrils round or oblong . . . . → *8*

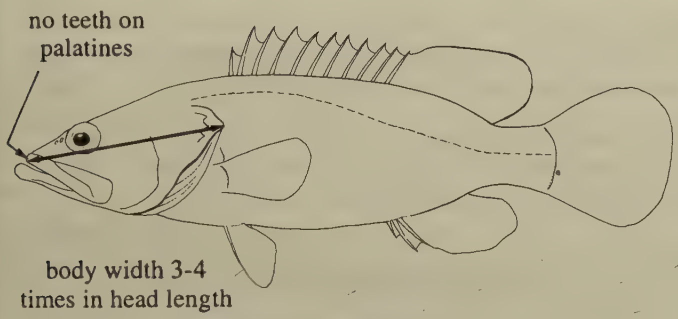

no teeth on palatines
body width 3-4 times in head length

Fig. 22 ***Anyperodon***

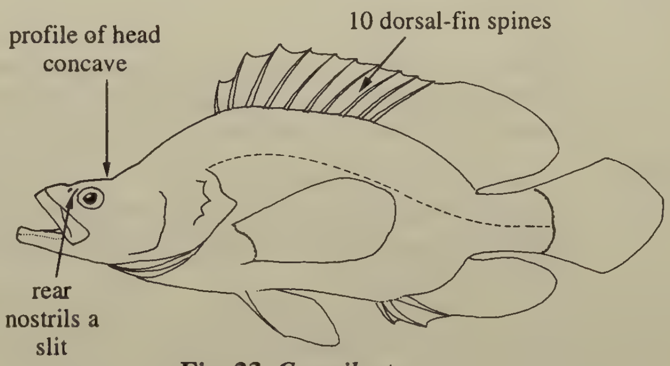

profile of head concave
10 dorsal-fin spines
rear nostrils a slit

Fig. 23 ***Cromileptes***

8a. Large antrorse spine at corner of preopercle (covered by skin); snout short, less than or equal to orbit diameter (Fig. 24) (eastern Pacific and western Atlantic) . . . . *Alphestes*

8b. No large antrorse spine on corner of preopercle (but there may be a few enlarged, ventrally directed serrae there); snout longer than orbit diameter . . . . → *9*

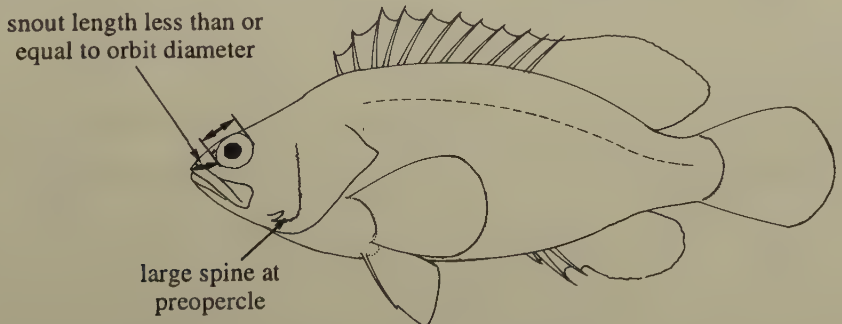

snout length less than or equal to orbit diameter
large spine at preopercle

Fig. 24 ***Alphestes***

9a. Pectoral fins distinctly asymmetric, the fifth or sixth ray longest (Fig. 25); dorsal fin with IX spines and 17 or 18 rays; caudal fin truncate (Fig. 26) (Indo-Pacific) . . . . *Aethaloperca*

9b. Pectoral fins symmetric or nearly so, the middle rays longest (Fig. 25); dorsal fin with IX to XI spines and 12 to 21 rays; caudal fin rounded, truncate or emarginate . . . . → *10*

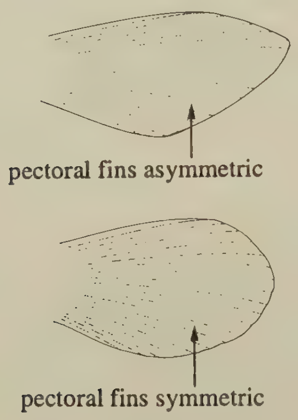

pectoral fins asymmetric
pectoral fins symmetric

Fig. 25

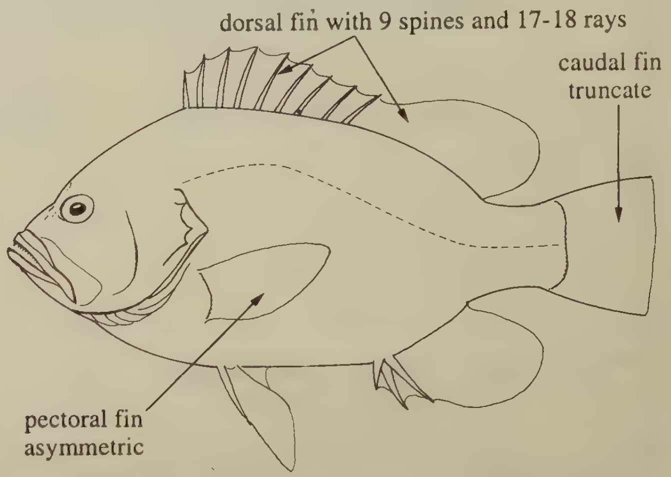

dorsal fin with 9 spines and 17-18 rays
caudal fin truncate
pectoral fin asymmetric

Fig. 26 ***Aethaloperca***

10a. Dorsal-fin spines IX . . . . → *11*

10b. Dorsal-fin spines X or XI (IX in one eastern Pacific species) . . . . → *12*

11a. Caudal fin truncate; head small, its length 2.9 to 3.2 times in standard length; distal part of maxilla of adults with a prominent step or hook-like process on lower edge (usually hidden by upper lip); dorsal-fin membranes not incised between the spines (Fig. 27) (Indo-Pacific) . . . . . *Gracila*

11b. Caudal fin more or less rounded (truncate in *C. polleni*); head length 2.2 to 3.1 times in standard length; maxilla of adults with a knob or protuberance at lower rear corner (usually hidden by upper lip); dorsal-fin membranes distinctly incised between the spines (Fig. 28) (all 3 oceans) . . . . *Cephalopholis*

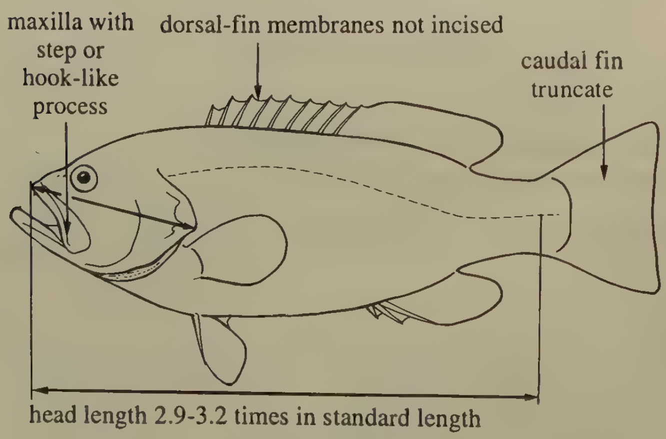

maxilla with step or hook-like process
dorsal-fin membranes not incised
caudal fin truncate
head length 2.9-3.2 times in standard length

Fig. 27 ***Gracila***

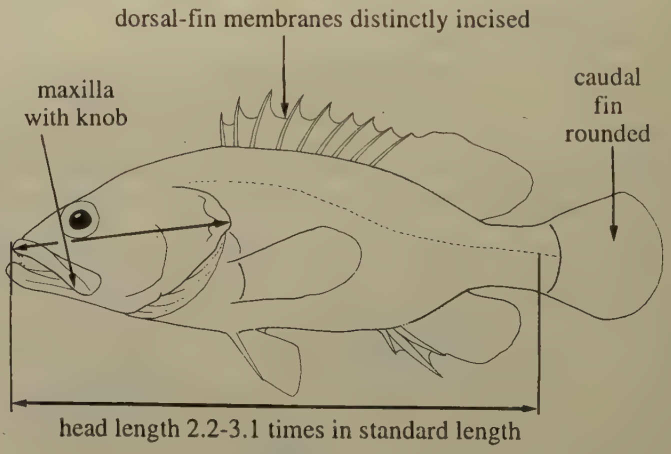

dorsal-fin membranes distinctly incised
maxilla with knob
caudal fin rounded
head length 2.2-3.1 times in standard length

Fig. 28 ***Cephalopholis***

12a. Body deep and compressed, the depth distinctly greater than head length and contained 2.1 to 2.7 times in standard length; dorsal fin with XI spines and 18 to 21 rays (Fig. 29) . . . . → *13*

12b. Body elongate, robust, to deep and compressed, the depth 2.3 to 4.1 times in standard length, usually less than head length; dorsal fin with IX to XI spines and 12 to 19 rays (Fig. 30) . . . . → *14*

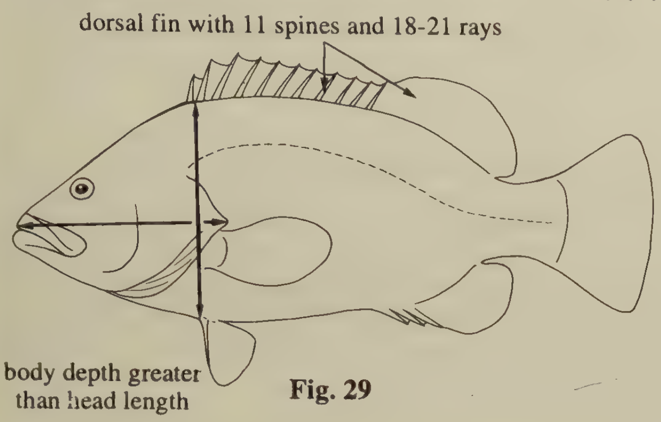

dorsal fin with 11 spines and 18-21 rays
body depth greater than head length

Fig. 29

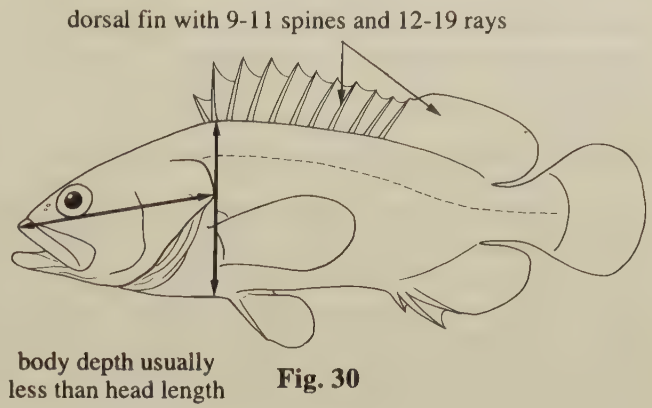

dorsal fin with 9-11 spines and 12-19 rays
body depth usually less than head length

Fig. 30

13a. Body scales smooth; head length 2.5 to 2.8 times in standard length (Fig. 31) (eastern Pacific, western Atlantic and western Indian Ocean) . . . . ***Dermatolepis***

13b. Body scales ctenoid; head length 3.0 to 3.4 times in standard length (Fig. 32) (western Pacific and eastern Indian Ocean) . . . . ***Triso***

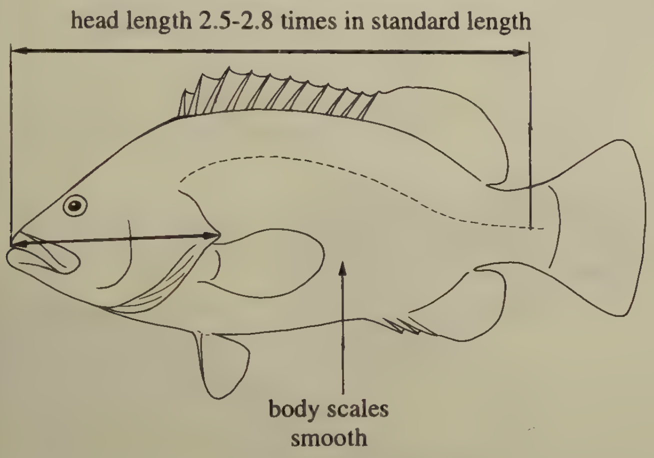

head length 2.5-2.8 times in standard length
body scales smooth

Fig. 31 ***Dermatolepis***

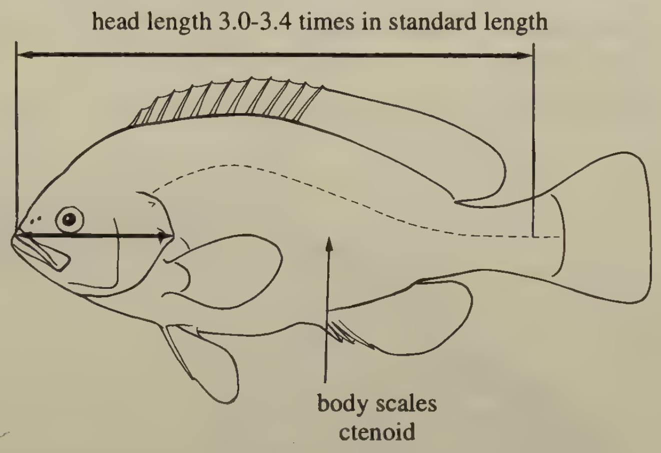

head length 3.0-3.4 times in standard length
body scales ctenoid

Fig. 32 ***Triso***

14a. Anal-fin rays 7 to 10 (rarely 10); body depth at dorsal-fin origin usually more than depth at anus; caudal fin usually rounded (truncate in some species, but rarely emarginate or concave) (Fig. 33) (all 3 oceans) . . . . ***Epinephelus***

14b. Anal-fin rays 10 to 13; body depth at dorsal-fin origin not more than depth at anus; caudal fin truncate, emarginate or concave (Fig. 34) (Atlantic and eastern Pacific Ocean) . . ***Mycteroperca***

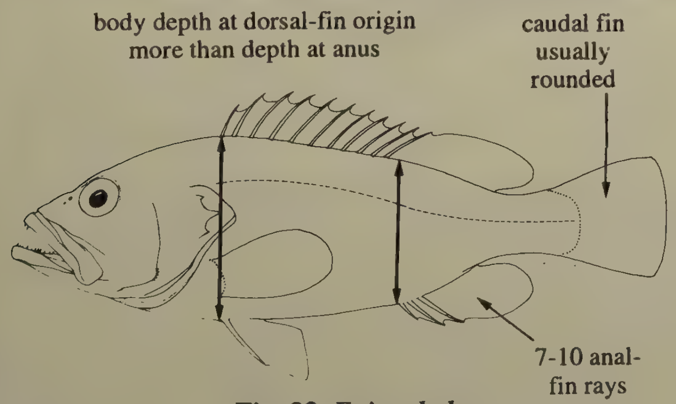

body depth at dorsal-fin origin more than depth at anus
caudal fin usually rounded
7-10 anal-fin rays

Fig. 33 ***Epinephelus***

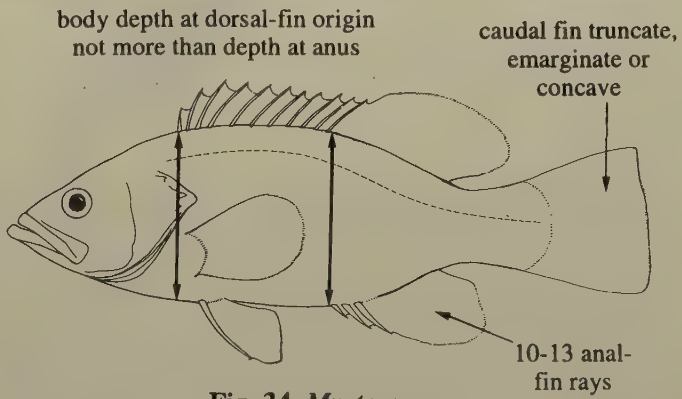

body depth at dorsal-fin origin not more than depth at anus
caudal fin truncate, emarginate or concave
10-13 anal-fin rays

Fig. 34 ***Mycteroperca***

2.4 Information by genus and species

Aethaloperca Fowler, 1904

SERRAN Aethal

Aethaloperca Fowler, 1904:522; type species, *Perca rogaa* Forsskål, 1775, by original designation and monotypy; proposed as a subgenus.

Synonyms: None.

Species: A single species widely distributed in the Red Sea and Indo-West Pacific region.

Remarks: The genus *Aethaloperca* is closely related to *Cephalopholis* and *Gracila* which also have IX dorsal-fin spines and several trisegmental pterygiophores in the dorsal and anal fin. Smith-Vaniz et al. (1988) discussed the relationships of these genera, and we agree with their decision to recognize *Aethaloperca* as a valid genus. It differs from *Cephalopholis* and *Gracila* in the configuration of the pectoral and median fins and in some cranial features (the anteriorly converging parietal crests and the well-developed median crest on the frontals that extends to the rear edge of the ethmoidal depression). *Aethaloperca* also differs from *Gracila* in the shape of the maxilla and in having a larger head and deeper body.

Aethaloperca rogaa (Forsskål, 1775)

Fig. 35; Pl. IA

SERRAN Aethal 1

Perca rogaa Forsskål, 1775:38 (type locality: Red Sea, Jeddah, Saudi Arabia).

Synonyms: *Perca lunaris* Forsskål, 1775:39 (type locality: Al Hudaydah [Yemen] and Jeddah). *Cephalopholis rogaa.*

FAO Names: **En** - Redmouth grouper; **Fr** - Vielle roga; **Sp** - Cherna roga.

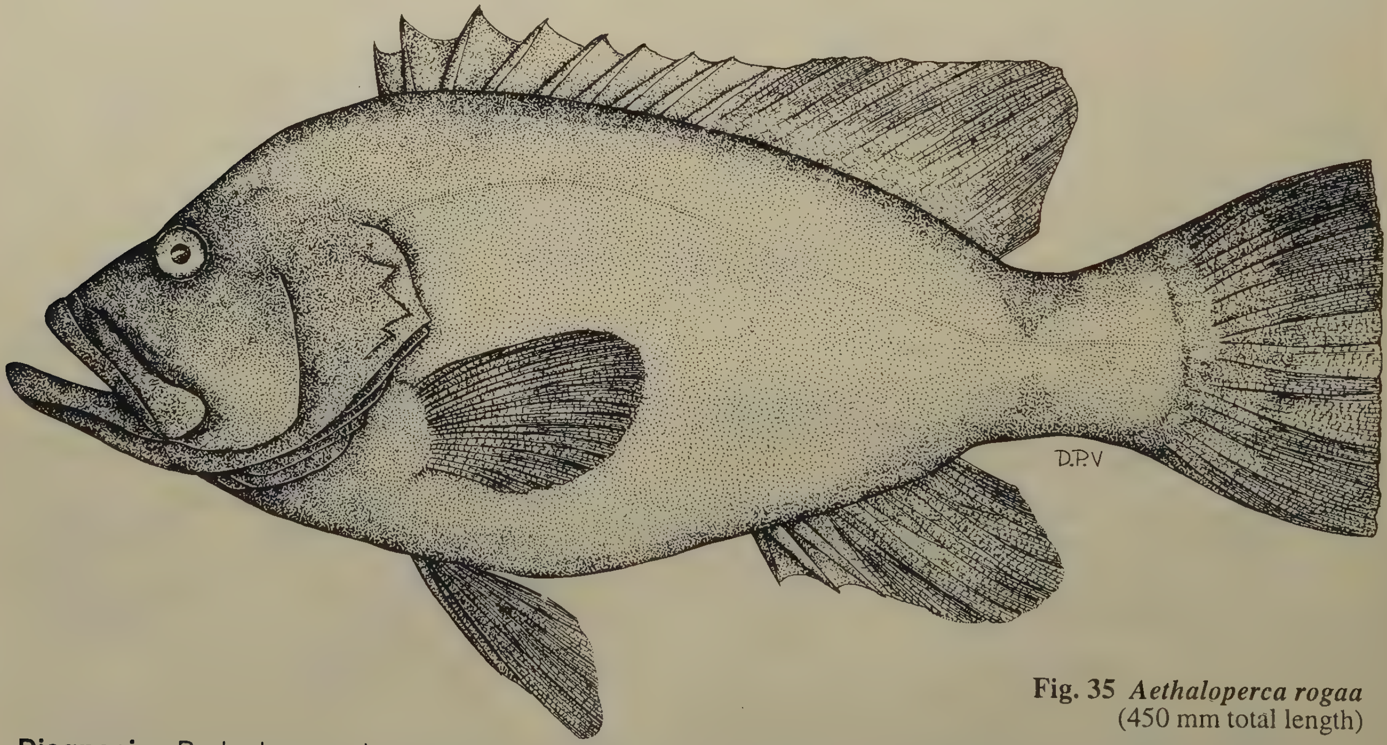


Fig. 35 *Aethaloperca rogaa* (450 mm total length)

Diagnosis: Body deep and compressed, the depth greater than the head length and contained 2.1 to 2.4 times in standard length, the body width contained 2.3 to 2.8 times in the depth. Head length contained 2.5 to 2.7 times in standard length; interorbital area convex; dorsal head profile steep, straight or slightly concave along the snout and distinctly convex from eye to dorsal fin; preorbital depth contained 6.5 to 9.2 times in head length; preopercle finely serrate, the lower edge fleshy; subopercle and interopercle smooth or with minute serrae; opercle with 3 flat spines, the middle one closer to the lower spine; upper edge of operculum convex; rear nostrils round or oval, not much larger than front ones; maxilla reaches past eye; ventroposterior corner of maxilla with a distinct bony protuberance; supramaxilla slender; small canines at front of jaws, none elsewhere; 2 to 4 rows of small slender teeth at side of lower jaw; palatine teeth present. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb, the longest gill raker slightly longer than longest gill filaments. Dorsal fin with IX spines and 17 or 18 rays, the fin origin over opercle; dorsal-fin membranes slightly incised between the spines, the third or fourth spine longest; anal fin with III spines and 8 or 9 rays; middle dorsal- and anal-fin rays elongate in adults, giving these fins an angular profile, with the rear margin almost vertical; pectoral fins asymmetric, with 17 to 19 rays, the fifth or sixth ray longest; a well-developed scaly flap of skin joining upper pectoral-fin rays to body; pelvic fins subequal to pectoral fins, reaching to or beyond anus; caudal fin truncate, with 8 branched rays and 9 procurrent rays in upper part and 7 branched rays and 8 procurrent rays in lower part. Scales on body ctenoid, with auxiliary scales; lateral-line scales 48 to 54; lateral-scale series 94 to 104. Pyloric caeca 10. Supraneural bones 2, not noticeably curved; dorsal and anal fins with 3 or 4 trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore not excavated for tip of third neural spine; epipleural ribs on vertebrae 1 to 10; cranium cuneiform, high posteriorly, with an elevated supraoccipital crest continuous with a well-developed median crest on the frontals; parietal crests convergent anteriorly, not reaching frontals; dorsolateral crests on frontals are approximately parallel, project laterally and are medial to and separate from the postorbital processes; interorbital region of cranium distinctly convex. **Colour**: Dark brown to black, occasionally with an orange cast, usually with a pale vertical bar on side of abdomen; distal part of spinous dorsal fin dark orange to brownish red; inside of mouth, gill cavity and upper jaw membranes reddish orange. Juveniles with a broad white posterior margin on caudal fin and a narrow white margin on soft dorsal fin; Allen and Steene (1987) show a 30 cm total length juvenile from the Maldives with a yellow-green spot on each body scale and the median fins with a pale bluish grey margin posteriorly.

Geographical Distribution: Red Sea to South Africa and east to the Gilbert Islands (Kiribati) in the central Pacific; Japan, Philippines, Indonesia, Australia, Papua New Guinea, Solomon Islands, Caroline Islands, Palau, Thailand, India, Pakistan, Persian Gulf, Gulf of Oman, and probably all of the tropical islands of the Indian Ocean (although not yet found at Réunion or Mauritius) (Fig. 36).

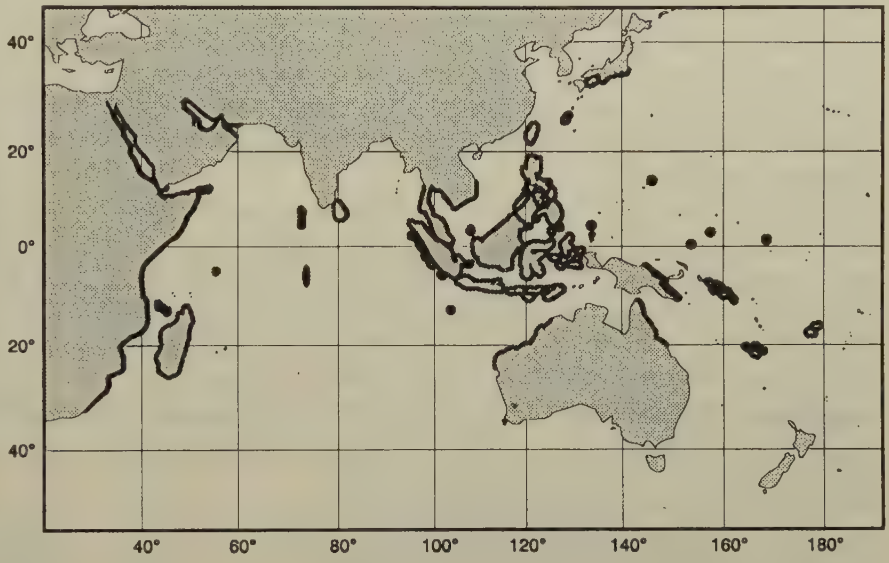


Fig. 36

Habitat and Biology: *Aethaloperca* prefers well-developed coral reefs in depths of 3 to at least 60 m. Usually seen in or near caves and holes in the reef. Morgans (1982) reported that small fishes (including *Pempheris* sp., a common cave dweller) are the primary food of this species, and that it also eats stomatopods (*Pseudosquilla* sp.). Preliminary data indicate that it spawns at any time of the year and matures (females?) at a length of about 35 cm standard length (Morgans, 1982).

Size: Maximum 60 cm total length.

Interest to Fisheries: An uncommon species, occasionally seen in markets. Caught with hook-and-line, spear, and probably in traps.

Local Names: JAPAN: Kurohata; KENYA (Swahili): Chewa, Tewa; PALAU: Chubei; PHILIPPINES: Lapulapung itim (Tagalog), Kubing (Visayan); SEYCHELLES: Matongo; SOUTH AFRICA: Redmouth rockcod, Rooibek-kabeljou; TANZANIA (Swahili): Chewa, Tewa.

Literature: Schroeder (1980); Randall (1983); Randall and Ben-Tuvia (1983); Heemstra and Randall (1984, 1986); Kuronuma and Abe (1986); Katayama (1988); Winterbottom et al. (1989); Myers (1989); Randall and Heemstra (1991).

Alphestes Bloch and Schneider, 1801

SERRAN Alph

Alphestes Bloch and Schneider, 1801:236; type species, *Epinephelus afer* Bloch, 1793 by subsequent designation of Jordan and Swain, 1885:394.

Synonyms: *Prospinus* Poey in Gill, 1863:236; type species, *Plectropoma chloropterum* Valenciennes in Cuv. and Val., 1828 (= *Alphestes afer*) by monotypy.

Diagnostic Features: Small compressed groupers with large eyes, short snout, and coloration that resembles their benthic habitat. Body depth less than head length and contained 2.3 to 3.1 times in standard length, the body width contained 1.9 to 2.6 times in the depth. Head length contained 2.4 to 2.6 times in standard length, the dorsal head profile nearly straight; snout length less than or subequal to orbit diameter; preorbital narrow, its depth contained 18 to 26 times in head length; preopercle subangular, the posterior edge distinctly serrate, with a large spine (usually hidden by skin) directed downward and forward at the "angle"; rear nostrils round or oval, not much larger than front ones; ventral edge of maxilla smoothly curved (no step or bony knob at posterior end); supramaxilla well developed; a pair of small canines (hidden by lips) at front of both jaws; 3 to 5 rows of small slender teeth at side of lower jaw and similar but smaller teeth on vomer and palatines. Dorsal fin with XI spines and 17 to 19 soft rays, the fin origin over opercle and in front of vertical at upper end of pectoral-fin base, the membranes incised between the spines; anal fin with III spines and 9 rays; caudal fin rounded, with 8 branched rays and 7 procurrent rays in upper part and 7 branched rays and 7 procurrent rays in lower part. Midlateral-body scales smooth. Supraneural bones 2, the posterior one approximately straight, about three-fourths length of first one and situated just anterior to tip of second neural spine; no trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore not excavated for tip of third neural spine; epipleural ribs on vertebrae 1 to 9; skull with well-developed cranial crests, the frontoparietal crests parallel; no transverse wall on supraethmoid, which forms floor of pit between end of frontals; medial process of epiotics produced, much longer than lateral process; interorbital width less than vomer width.

Habitat and Biology: The mutton hamlets are shallow-water, crypticly coloured, secretive fishes that are easily overlooked in their typical seagrass habitat. They are sedentary during the day, hiding in crevices or lying among seaweed, and rely on their effective camouflage to escape detection. Sometimes they will even lie on their side and partly cover themselves with sand. With their cryptic coloration and sedentary habitats, they resemble scorpaenid fishes and can easily be approached or even touched. Mutton hamlets are nocturnal predators feeding mainly on benthic crustaceans.

Geographic Distribution: The genus *Alphestes* is represented in the eastern Pacific and western Atlantic oceans.

Interest to Fisheries: Because of their small size, the mutton hamlets are of little commercial importance.

Species: The genus comprises three species:

Alphestes afer: Western Atlantic and Caribbean Sea.
Alphestes immaculatus: Eastern Pacific
Alphestes multiguttatus: Eastern Pacific.

Remarks: *Alphestes* was regarded as a subgenus of *Epinephelus* by C.L. Smith (1971), who wrote, "Although the dorsolateral (skull) crests are parallel to each other they are more similar to those of *Epinephelus* than to those of *Mycteroperca* and the general aspect of the skull is clearly that of other species of *Epinephelus*. The postocular skull process bears the same relationship to the crest that it does in *Epinephelus* and is unlike that of *Mycteroperca*." We agree that the cranium of *Alphestes afer* is more similar to the crania of western Atlantic species of *Epinephelus* than it is to any *Mycteroperca* species, but this does not mean that *Alphestes* and *Epinephelus* are necessarily congeneric. Smith (1971) gave no diagnosis for his (expanded) genus *Epinephelus*, nor did he mention any characters that might indicate its monophyletic status. The large antrorse spine at the corner of the preopercle in *Alphestes* species does not occur on any species of *Epinephelus*. The only other grouper with a single large antrorse spine at the corner of the preopercle is *Gonioplectrus hispanus*; and it differs markedly from *Alphestes* in dorsal- and anal-fin counts, development of opercular spines, maxilla shape, head shape, body shape, and cranial configuration. Although *Alphestes* may be more closely related to *Epinephelus* than to any other genus, we believe that the distinctive antrorse preopercle spine, head configuration (very short snout and narrow preorbital), and smooth scales justify recognition of a separate genus for these three species. Johnson and Keener (1984) described a distinctive feature of the late postlarvae (15 mm) and small juveniles (38 to 60 mm) of *Alphestes*: the dorsal and lateral surfaces of the neurocranium from mid orbit to the nape are extremely rugose. This condition was not seen in other grouper larvae that they examined and is further justification for the recognition of *Alphestes* as a valid genus. The sedentary behaviour of *Alphestes* (see above) is also unlike any other grouper known to us.

Key to the Species of *Alphestes*:

1a. Pectoral fins orange with distinct white spots, sometimes with faint dusky mottling but no dark crossbars; depth of caudal peduncle 12 to 14% of standard length (for fish 12 to 21 cm standard length) (Fig. 37, Plate I) (western Atlantic) . . . . *A. afer*

1b. Pectoral fins pale, with dark crossbars formed by series of dark spots on the fin rays; peduncle depth 10.6 to 12.0% of standard length . . . . → *2*

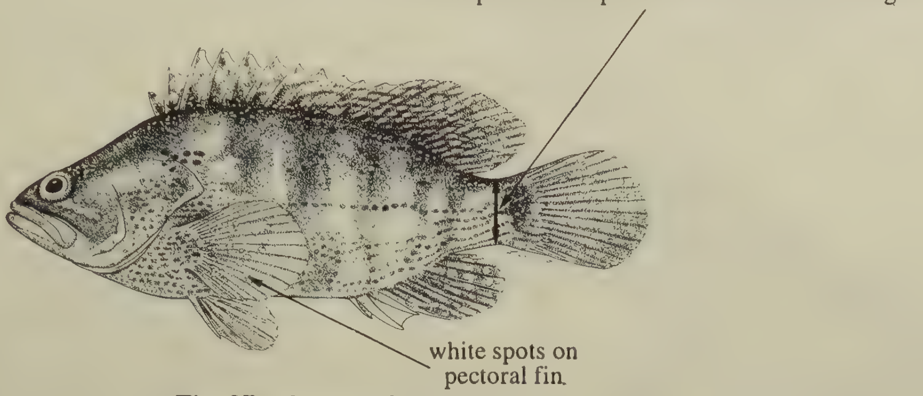

caudal-peduncle depth 12-14% of standard length
white spots on pectoral fin.

Fig. 37 *Alpestes afer*

2a. Pectoral fins with 7 or 8 irregular dark crossbars; body mottled and covered with black specks; pectoral-fin rays 16 to 18; dorsal-fin rays 17 to 19; body depth 2.3 to 2.8 times in standard length (Fig. 38) (eastern Pacific, Gulf of California to Peru, Galapagos Islands) . . . . *A. immaculatus*

2b. Pectoral fins with 5 or 6 broad dark crossbars; body with numerous small dark spots forming horizontal dark streaks posteriorly and extending onto soft dorsal and caudal fins; pectoral-fin rays 17 to 19; dorsal-fin rays 18 to 20; body depth 2.7 to 3.1 times in standard length (Fig. 39) (eastern Pacific, Gulf of California to Panamá) . . . . *A. multiguttatus*

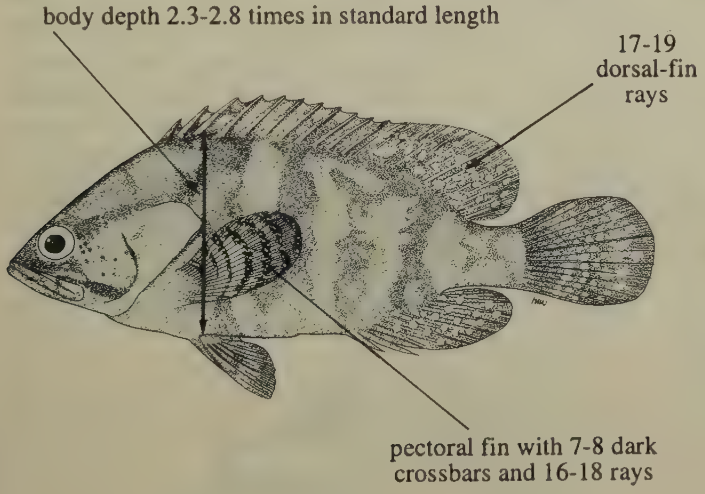

body depth 2.3-2.8 times in standard length
17-19 dorsal-fin rays
pectoral fin with 7-8 dark crossbars and 16-18 rays

Fig. 38 *Alphestes immaculatus*

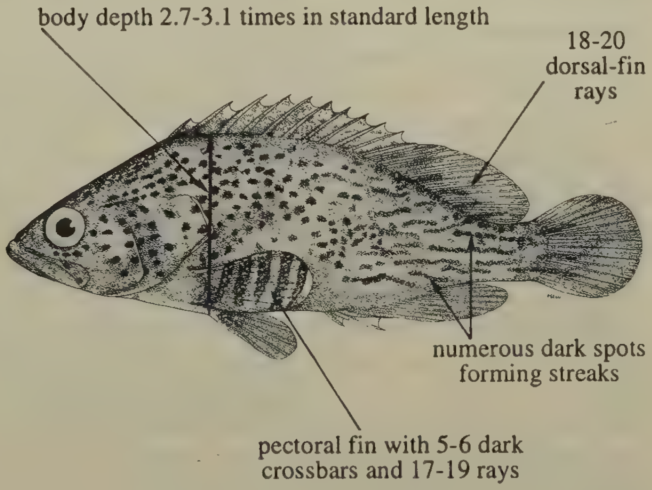

body depth 2.7-3.1 times in standard length
18-20 dorsal-fin rays
numerous dark spots forming streaks
pectoral fin with 5-6 dark crossbars and 17-19 rays

Fig. 39 *Alphestes multiguttatus*

Alphestes afer (Bloch, 1793) Fig. 40; Pl. IB SERRAN Alph 1

Epinephelus afer Bloch, 1793:12, Pl. 327 (type locality: "Guinea" [erroneous]).

Synonyms: ***Plectropoma chloropterum*** Valenciennes in Cuv. and Val., 1828:398 (type locality: Dominican Republic and Martinique). ***Plectropoma monacanthus*** Müller and Troschel, 1848:665 (type locality: Barbados). ***Epinephelus lightfooti*** Fowler, 1907:258 (type locality: Santo Domingo, Dominican Republic).

FAO Names: **En** - Mutton hamlet; **Fr** - Varech; **Sp** - Guaseta.

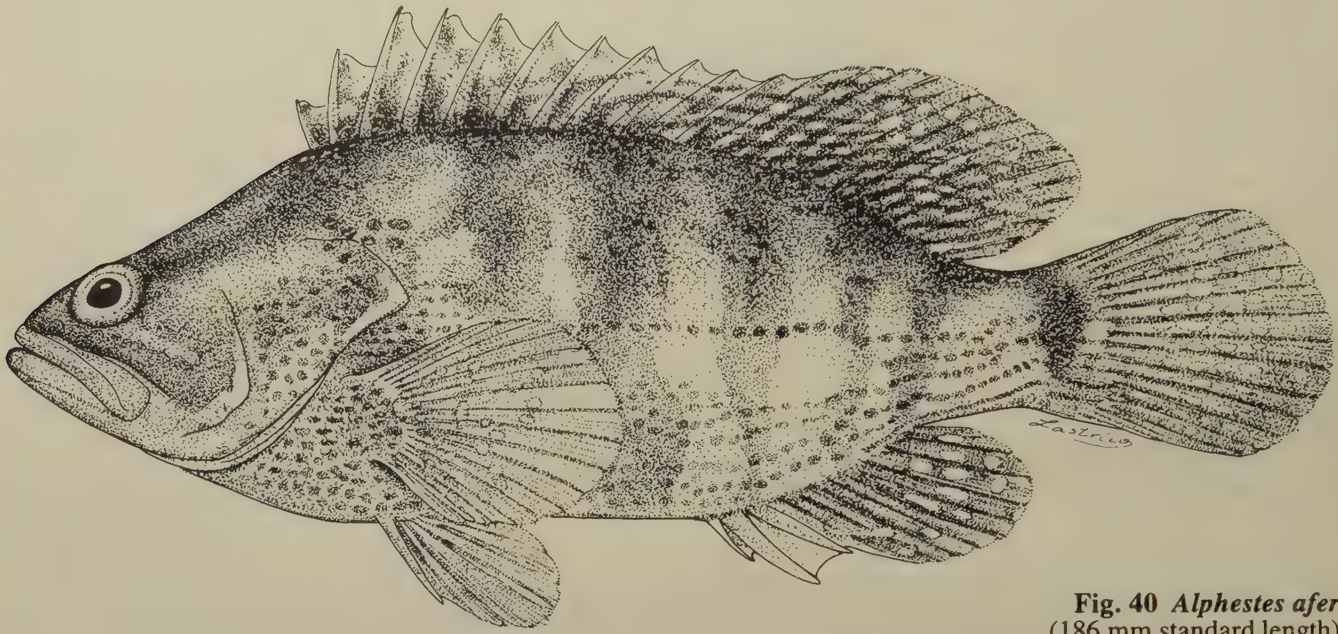


Fig. 40 ***Alphestes afer***
(186 mm standard length)

Diagnostic Features: Body depth slightly less than head length, depth contained 2.4 to 3.1 times in standard length (for fish 13 to 22 cm standard length); caudal-peduncle depth 12.0 to 14.0% of standard length. Eye diameter greater than snout length, eye diameter contained 4.1 to 5.3 times in head length; preopercle rounded, the posterior edge distinctly serrate with a large spine (usually hidden by skin) directed downward and forward at the "angle." Gill rakers 6 to 8 on upper limb, 16 or 17 on lower limb, 22 to 25 total. Dorsal fin with XI spines and 17 to 19 rays; anal fin with III spines and 9 rays; pectoral fins with 16 or 17 rays; caudal fin rounded. Scales smooth; lateral-line scales 55 to 61; lateral-scale series 68 to 77. **Colour**: Head, body, and median fins olivaceous or light brown, irregularly blotched, and barred with dark brown, and densely spotted with orange; head, body, and all fins with scattered, small white spots; pectoral fins orange or yellow with faint brownish reticulations.

Geographical Distribution: Western Atlantic: Bermuda, south Florida, Bahamas, Cuba, West Indies, Panama, Venezuela, and southward to the state of São Paulo, Brazil (Fig. 41). Boulenger's (1895) record of *E. afer* from the Falkland Islands is based on the stuffed specimen reported by Günther (1859); this specimen probably came from Brazil and was mislabelled or mixed up with specimens from the Falklands.

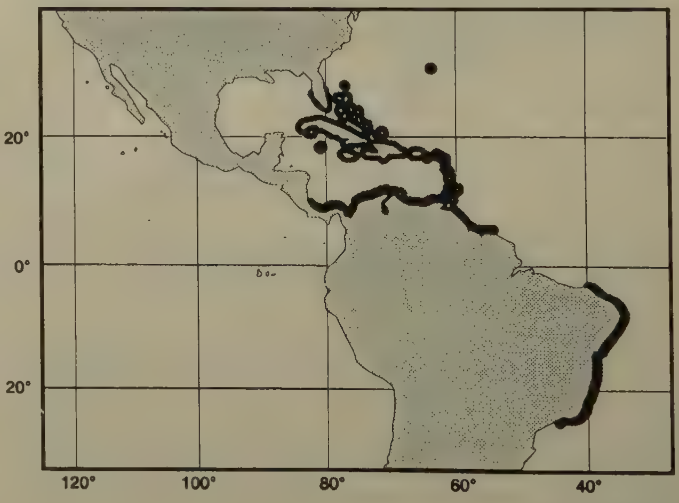


Fig. 41

Habitat and Biology: See above under the genus account. Thompson and Munro (1983) estimated the number of eggs in 4 females to range from 157 512 to 223 706 per fish.

Size: Maximum total length about 33 cm.

Interest to Fisheries: Although common in the Caribbean area, the mutton hamlet is too small to be of much commercial importance.

Local Names: BRAZIL: Garoupa-gato.

Literature: Randall (1968); Smith (1971, in part, not the eastern Pacific specimens which are *A. immaculatus*); Figueiredo and Menezes (1980).

Remarks: Smith (1971) synonymized the eastern Pacific species *Alphestes galapagensis* Fowler, *A. fasciatus* Hildebrand, and *A. immaculatus* Breder with the Atlantic species *A. afer*. We believe that these amphi-American populations are distinct species, as indicated by their different colour patterns and the greater depth of the caudal peduncle in *A. afer*. The distinctive dark crossbars on the pectoral fins of *A. immaculatus* are lacking in *A. afer*, and *A. afer* usually has 23 or 24 total gill rakers, whereas *A. immaculatus* has 20 to 22 gill rakers. Furthermore, Johnson and Keener (1984) have shown that the dorsal- and pelvic-fin spines of larval *A. afer* differ considerably in their distinctive ornamentation from the spines of *A. immaculatus* (which they refer to as the Pacific population of *A. afer*). Also these authors concluded that the striking differences in spine morphology suggest that these two populations are specifically distinct.

Alphestes immaculatus Breder, 1936 Fig. 42 SERRAN Alph 2

Alphestes immaculatus Breder, 1936:22, Fig. 9 (type locality: not stated in original description; Bahia San Francisquito [Gulf coast of northern Baja California] is given on the label with the holotype, BOC 596, 82 mm standard length).

Synonyms: *Alphestes galapagensis* Fowler, 1944:342, fig. 186 (Chatham Island, Galapagos). *Alphestes fasciatus* Hildebrand, 1946:163, fig. 36 (Lobos de Afuera Bay, Peru; holotype USNM 127950, 160 mm standard length).

FAO Names: **En** - Pacific mutton hamlet; **Fr** - Varech pacifique; **Sp** - Guaseta pacifico.

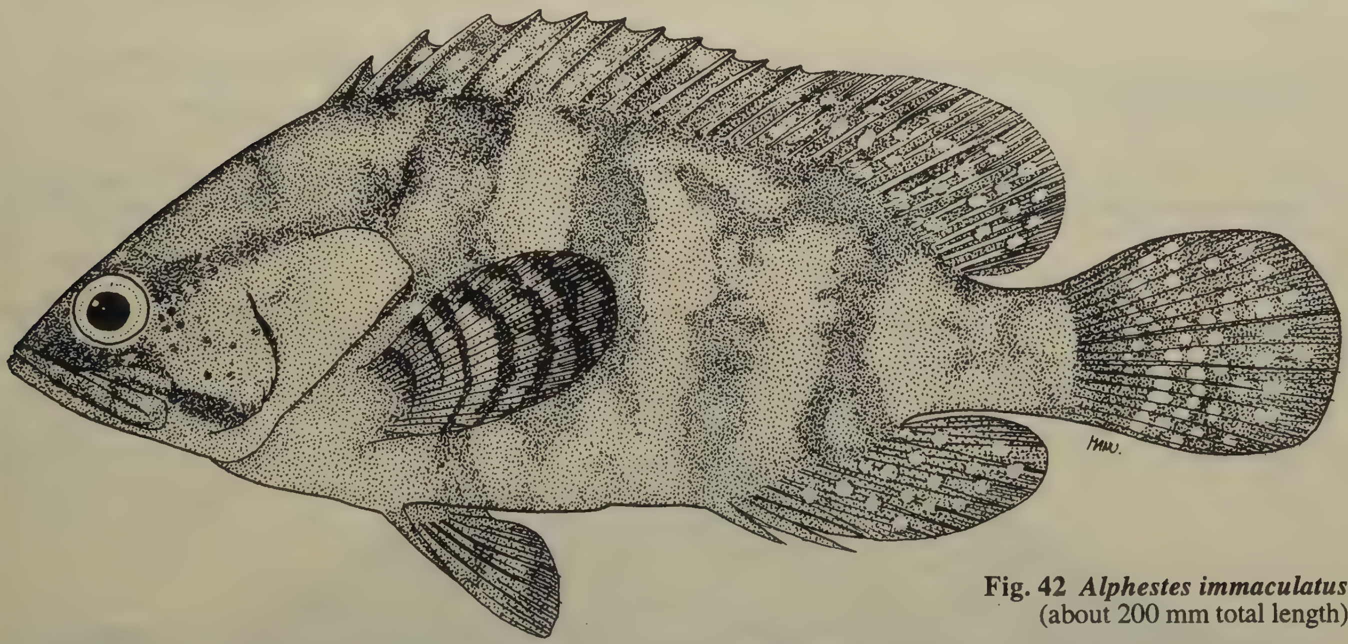


Fig. 42 ***Alphestes immaculatus***
(about 200 mm total length)

Diagnostic Features: Body depth less than or equal to head length, depth contained 2.3 to 2.8 times in standard length (for fish 13 to 21 cm standard length); caudal-peduncle depth 10.6 to 12.0% of standard length. Eye diameter subequal to snout length, contained 4.1 to 5.5 times in head length; preopercle rounded, the posterior edge distinctly serrate, with a large spine (usually hidden by skin) directed downward and forward at the "angle." Gill rakers 5 to 7 on upper limb, 14 to 16 on lower limb, 20 to 22 total. Dorsal fin with XI spines and 17 to 19 rays; anal fin with III spines and 9 rays; pectoral fins with 16 to 18 rays; caudal fin rounded. Scales smooth; lateral-line scales 55 to 63, lateral-scale series 71 to 75. **Colour**: Head and body marbled reddish brown, with obscure bars and small dark spots; 7 or 8 irregular transverse series of small dark spots on pectoral fin; pale spots and blotches over all of head, body, and median fins.

Geographical Distribution: Eastern tropical Pacific from the northern Gulf of California to Peru and the Galapagos Islands (Fig. 43).

Habitat and Biology: See above under the genus account.

Size: Maximum total length about 30 cm.

Interest to Fisheries: None.

Local Names: MEXICO: Guaseta.

Literature: Thomson et al. (1979 [as "*Epinephelus* (*Alphestes*) *afer*"]); Hobson (1968 [as "*Alphestes multiguttatus*," which is rare in the Gulf of California and has not been definitely recorded from Baja California]).

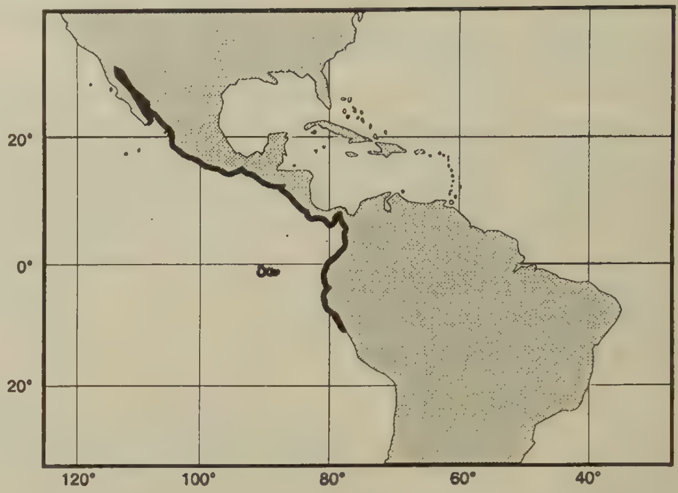


Fig. 43

Remarks: As indicated in the account of *A. afer* above, we regard *A. immaculatus* as a valid species. When Hildebrand described *Alphestes fasciatus* as a new species in 1946, he apparently was not aware of Fowler's description of *A. galapagensis*, which was published in 1944.

The original description of *A. immaculatus* Breder (1936) was based on a juvenile of 82 mm standard length with an "almost uniform" colour pattern. The dorsal-fin soft-ray count of 17 for this holotype is one ray less than any of the *A. multiguttatus* for which we have data (range 18 to 20, mean =19, n = 42) but it is within the range of counts for *A. immaculatus* (range 17 to 19, mean = 18, n = 29, 5 fish with a count of 17 dorsal-fin rays). The holotype was collected at San Francisquito Bay in the northwestern Gulf of California, not the Galapagos, as listed by C.L. Smith (1971). According to Thomson et al. (1979), the pacific mutton hamlet ("*Epinephelus afer*") is much more common than the rivulated mutton hamlet (*A. multiguttatus*) in the Gulf of California. Although Thomson et al. (1979) correctly distinguish these two species on differences in colour pattern, their stated differences in fin-ray counts appear to be mean values for each species (no range in counts is given for either species).

Johnson and Keener (1984) described and illustrated the dorsal- and pelvic-fin spine morphology of the larvae (as "Pacific *E. afer*").

Alphestes multiguttatus (Günther, 1867)

Fig. 44

SERRAN Alph 3

Plectropoma multiguttatum Günther, 1867:600 (type locality: Panama).

Synonyms: *Epinephelus multiguttatus*.

FAO Names: **En** - Rivulated mutton hamlet; **Fr** - Varech veiné; **Sp** - Guaseta rayado.

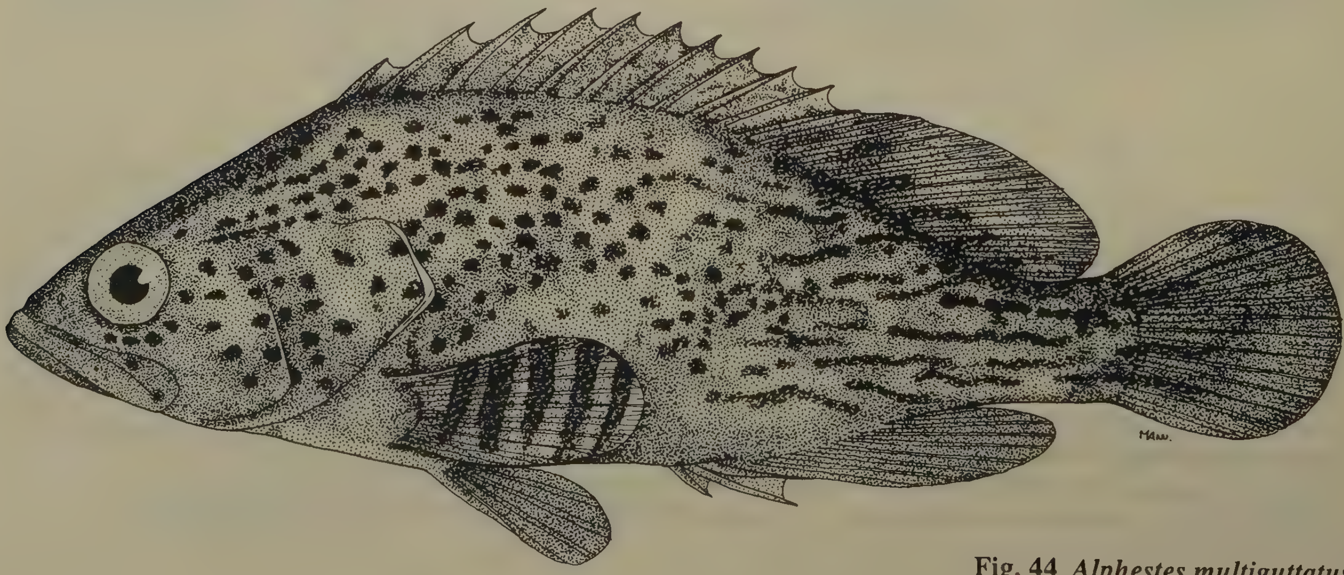


Fig. 44 *Alphestes multiguttatus* (167 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.7 to 3.1 times in standard length (for fish 13 to 20 cm standard length); caudal-peduncle depth 10.6 to 11.8% of standard length. Eye diameter slightly greater than snout length, contained 4.3 to 4.7 times in head length; preopercle rounded, the rear edge distinctly serrate with a large spine (usually hidden by skin) directed downward and forward at the "angle." Gill rakers 6 to 8 on upper limb, 14 to 16 on lower limb, 20 to 23 total. Dorsal fin with XI spines and 18 to 20 rays; anal fin with III spines and 9 rays; pectoral fins with 17 to 19 rays; caudal-fin rounded. Scales smooth; lateral-line scales 54 to 62; lateral-scale series 67 to 75. **Colour**: Head and body brownish, with small dark spots forming horizontal streaks posteriorly and extending onto soft dorsal and caudal fins; pectoral fins pale, with 5 or 6 broad, dark crossbars, which are darker and more distinct distally.

Geographical Distribution: Eastern tropical Pacific from northern Gulf of California to Panama (Fig. 45).

Habitat and Biology: Presumably like that of the other two species (see above under the genus account). Johnson and Keener (1984) have described and illustrated the dorsal- and pelvic-fin spines of the larvae and compared them with *Alphestes immaculatus* and *A. afer*.

Size: Maximum total length about 25 cm.

Interest to Fisheries: None.

Local Names: MEXICO: Pacific guaseta (Gulf of California).

Literature: Smith (1971); Thomson et al. (1979).

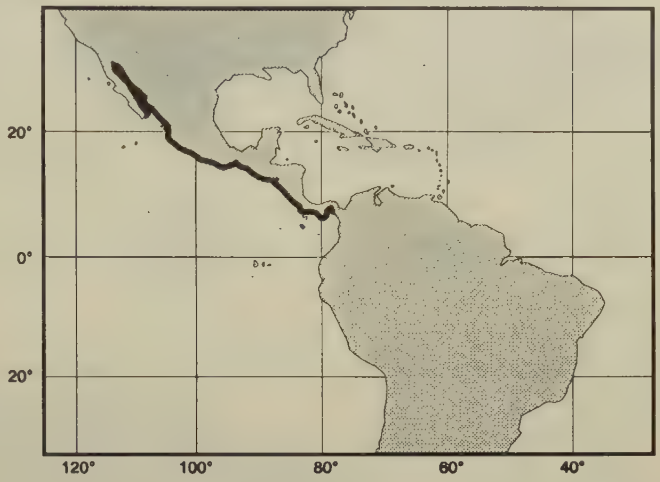


Fig. 45

Anyperodon Günther, 1859

SERRAN Anyper

Anyperodon Günther, 1859:95; type species, *Serranus leucogrammicus* Valenciennes in Cuv. and Val., 1828 by monotypy.

Synonyms: None.

Species: A single species widely distributed in the Indo-West Pacific region.

Remarks: This distinctive monotypic genus is probably most closely related to ***Epinephelus***, with which it shares XI dorsal-fin spines and the absence of trisegmental pterygiophores; but it differs from ***Epinephelus*** (and all other groupers) in its lacking teeth on the palatines. ***Anyperodon*** is also unique among groupers in its elongate and markedly compressed head and body (body width 11 to 15% of standard length); there are some other elongate groupers, but none of these are as compressed as ***Anyperodon***.

Anyperodon leucogrammicus (Valenciennes, 1828)

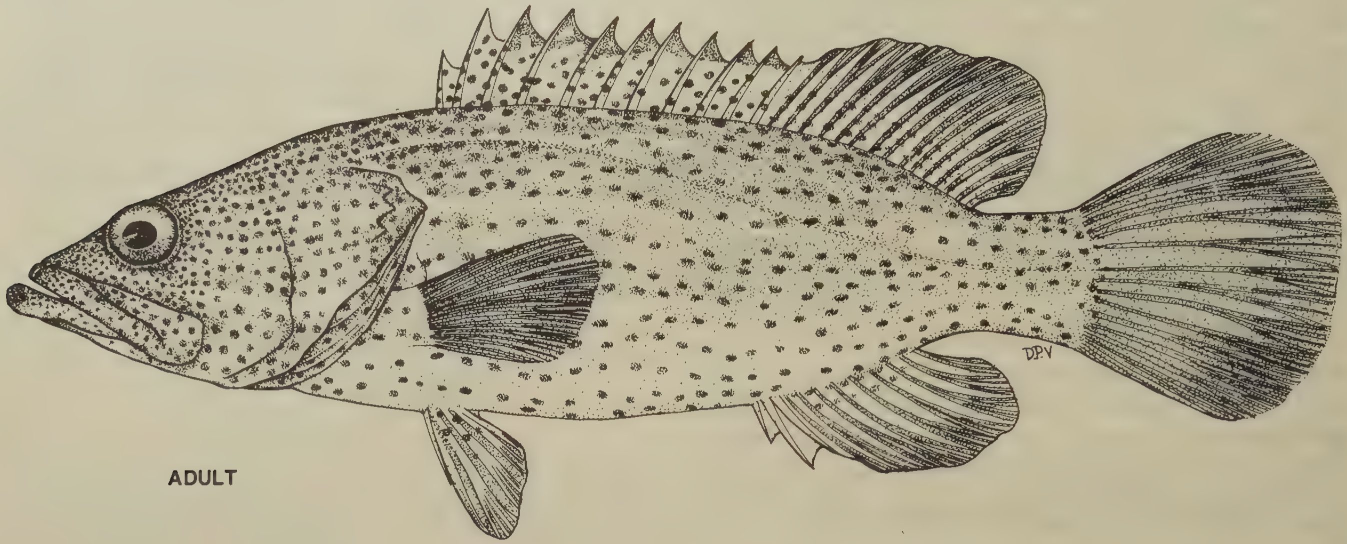
Fig. 46; Pl. IC

SERRAN Anyper 1

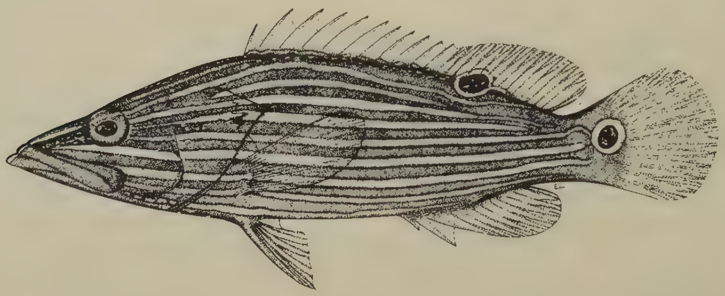
Serranus leucogrammicus Valenciennes in Cuv. and Val., 1828:347 (type locality: Seychelles).

Synonyms: ***Serranus micronotatus*** Rüppell, 1838:90 (type locality: Red Sea: Massaua [Mits'iwa] Ethiopia). ***Serranus urophthalmus*** Bleeker, 1855a:310 (type locality: Indonesia: Batu Archipelago).

FAO Names: **En** - Slender grouper; **Fr** - Mérou élégant; **Sp** - Mero elegante.



ADULT



JUVENILE

Fig. 46 *Anyperodon leucogrammicus*
(adult 294 mm standard length, juvenile about 75 mm total length)

Diagnostic Features: Body and head elongate and markedly compressed, the depth distinctly less than head length and contained 3.1 to 3.7 times in standard length (for fish 10 to 40 cm standard length), the body width contained 2.3 to 2.8 times in the depth. Head pointed, its length contained 2.3 to 2.5 times in standard length; interorbital region narrow, slightly concave, flat or slightly convex; dorsal head profile almost straight; preorbital narrow, its depth contained 14 to 17 times in head length; snout distinctly longer than eye; preopercle rounded, finely serrate, the lower serrae only slightly enlarged, the lower edge fleshy; ventral edge of interopercle with a shallow indentation; opercular spines small, the upper edge of operculum distinctly convex; diameter of posterior nostrils about twice that of anterior nostrils; maxilla reaches well past eye, the exposed part covered with tiny cycloid scales; no bony process on rear end of maxilla; supramaxilla well developed; no teeth on palatines; canines at front of jaws rudimentary or absent; teeth at sides of lower jaw subequal, in 2 or 3 irregular rows. Gill rakers 7 to 9 on upper limb, 14 to 17 on lower limb, the longest gill raker subequal to longest gill filaments. Dorsal fin with XI spines and 14 to 16 rays, the fin origin over the opercle, the membranes distinctly incised between the spines; anal fin with III spines and 8 or 9 rays; soft dorsal and anal fins rounded; pectoral and pelvic fins small, subequal, their length contained 1.9 to 2.4 times in head length; pectoral fins thin, transparent and symmetrical; pelvic fins not reaching anus; caudal fin rounded, with 8 branched rays and 10 procurrent rays in upper part and 7 branched rays and 9 procurrent rays in lower part. Midlateral-body scales ctenoid, with auxiliary scales; lateral-line scales 61 to 72; lateral-scale series 106 to 125. Supraneural bones 2, the posterior one curving forward and situated dorsal to tip of first neural spine; no trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore deeply excavated for tip of third neural spine; epipleural ribs on vertebrae 1 to 10; cranium low, the greatest height about 3 times in its length; parietal and median supraoccipital crests inconspicuous, not reaching frontals; frontals with an anterior median depression for reception of the tips of the ascending processes of the premaxillae. **Colour**: Adults greenish to brownish grey with numerous orange-red spots on head, body, dorsal fin, and basally on caudal fin; 4 longitudinal whitish bands or series of streaks often visible on postorbital head and body; membranes of soft dorsal, anal, and caudal fins clear. Juveniles (less than 8 cm total length) with longitudinal, dark-edged, pale bluish grey stripes on a gold background; a blue-edged black spot (or double spot) at base of caudal fin and in dorsal fin; an elongate, blackish spot often present on each side of snout in front of nostrils.

Geographical Distribution: Red Sea to Mozambique and east to the Marshall Islands, Samoa, and the Phoenix Islands; Japan, Philippines, Indonesia, Australia, Papua New Guinea, and probably all of the islands of the tropical Indian Ocean (Fig. 47).

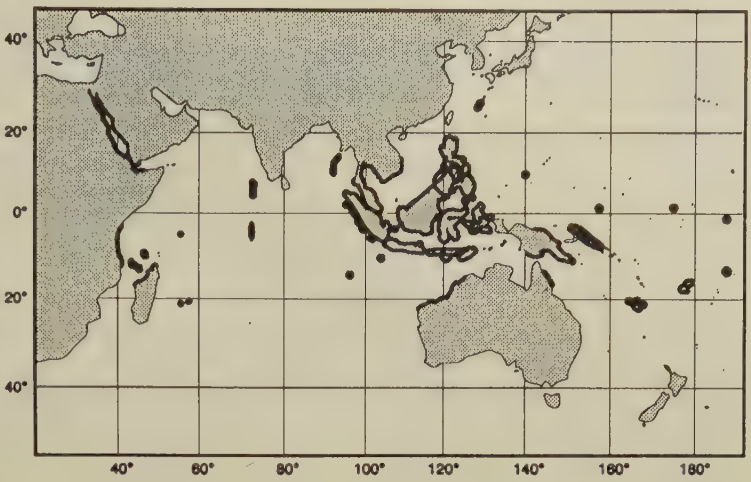


Fig. 47

Habitat and Biology: *Anyperodon* is a coral-reef species usually found on protected reefs in depths of 5 to 80 m. Adults are primarily piscivorous. According to Randall and Kuiter (1989) the distinctive blue and gold striped juveniles are mimics of the wrasse, *Halichoeres purpurescens* (Bloch and Schneider, 1801) and related species with a similar colour pattern. These wrasses feed on micro-invertebrates (much smaller than the food of like-sized *Anyperodon*), and this mimetic association presumably allows *Anyperodon* (in the guise of a harmless wrasse) to approach the small fishes and crustaceans on which it feeds.

Size: Maximum total length at least 52 cm.

Interest to Fisheries: Often seen in markets but not plentiful enough to be of commercial importance. Caught with hook-and-line, spear, and probably in traps.

Local Names: KENYA (Swahili): Chewa, Tewa; PAPUA NEW GUINEA: Balala; PALAU: Choloteachl; SEYCHELLES: Cheval du bois; SINGAPORE: Kerapu; TANZANIA (Swahili): Chewa, Tewa.

Literature: Morgans (1982); Randall and Ben-Tuvia (1983); Heemstra and Randall (1984, 1986); Katayama (1988); Allen and Steene (1987); Myers (1989); Winterbottom et al. (1989); Randall and Heemstra (1991).

Cephalopholis Bloch and Schneider, 1801

SERRAN Cephal

Cephalopholis Bloch and Schneider, 1801:311; type species, ***Cephalopholis argus*** Bloch and Schneider, 1801 by monotypy).

Synonyms: ***Enneacentrus*** Gill, 1866:105; type species, ***Serranus ouatalibi*** Valenciennes in Cuv. and Val., 1828 (=***Cephalopholis fulva***) by original designation. ***Petrometopon*** Gill, 1866:105; type species, ***Serranus guttatus*** Poey (a subsequent identification apparently based on ***Perca guttatus*** (non Linnaeus): Bloch, 1792 (=***Cephalopholis cruentata***) by original designation).

Diagnostic Features: Body oblong, robust, not strongly compressed, the depth contained 2.0 to 3.2 times in standard length, the body width contained 1.9 to 2.6 times in the depth. Head length contained 2.2 to 3.1 times in standard length. Interorbital area flat to slightly convex; snout distinctly longer than eye diameter; preorbital depth contained 8 to 13 times in head length; preopercle rounded, finely serrate, but without enlarged serrae at the "corner" and no antrorse spines on lower edge; ventral edge of interopercle may be finely serrate posteriorly, but there is no broad indentation; upper edge of operculum distinctly convex; anterior and posterior nostrils subequal; jaws with small canines at the front; teeth present on palatines; maxilla of adults with a distinct bony knob on the ventroposterior corner; supramaxilla well developed. Dorsal fin with IX spines and 13 to 17 rays, the fin origin over rear part of opercle and the fin membranes distinctly incised between the spines; no dorsal-fin spines or rays elongated; anal fin with III spines and 7 to 10 rays; soft dorsal and anal fins rounded; pectoral fins symmetrically rounded, the middle rays longest; caudal fin rounded or convex posteriorly (truncate in *C. polleni*), with 8 branched rays and 6 to 9 procurrent rays in upper part and 7 branched rays and 6 to 9 procurrent rays in lower part. Midlateral-body scales ctenoid. Supraneural bones 2, the posterior one straight or curved posteriorly, much smaller than the first one and situated just anterior to or above tip of second neural spine; dorsal fin with the last 4 to 7 pterygiophores trisegmental; anal fin with 3 to 5 trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore slightly to deeply excavated for tip of third neural spine; epipleural ribs on vertebrae 1 to 9 (except *C. sonnerati* and *C. igarashiensis* with epipleurals on vertebrae 1 to 10); cranium distinctly narrowed at interorbital region, the least interorbital width subequal to the vomer width and half or less than half of the width at lateral ethmoids; frontals separated anteriorly by the supraethmoid; no median crest on frontals; medial and lateral processes of epiotics subequal; parasphenoid straight or nearly so.

Habitat and Biology: Most species of *Cephalopholis* are secretive groupers seen hiding in or near coral reefs. Although some species (*C. boenak*, *C. cyanostigma*, *C. formosa*, *C. microprion* and *C. oligosticta*) are often seen in silty areas, most species of *Cephalopholis* prefer clear-water environments, from tidepools out to depths of 200 m.

Geographical Distribution: The genus is represented in all three major oceans, including both sides of the Atlantic, but it has not yet been found in the Mediterranean Sea.

Interest to Fisheries: Some species of *Cephalopholis* are abundant in certain areas and undoubtedly represent a significant source of protein for local people; but most species are of little commercial importance, because of their small size.

Species: The genus *Cephalopholis* comprises 22 species: two in the western Atlantic (*C. fulva* and *C. cruentata*), two in the eastern Atlantic (*C. nigri* and *C. taeniops*), one in the eastern Pacific (*C. panamensis*), and 17 in the Red Sea plus Indo-Pacific region (*C. aitha*, *C. argus*, *C. aurantia*, *C. boenak*, *C. cyanostigma*, *C. formosa*, *C. hemistiktos*, *C. igarashiensis*, *C. leopardus*, *C. microprion*, *C. miniata*, *C. oligosticta*, *C. polleni*, *C. sexmaculata*, *C. sonnerati*, *C. spiloparaea*, and *C. urodeta*).

Remarks: Jordan and Evermann (1905) resurrected the genus *Cephalopholis* from the synonymy of *Epinephelus* (="*Serranus*") where it had lain dormant since its original description by Schneider in 1801. *Cephalopholis* was widely used as a valid genus until C.L. Smith (1971) demoted it to subgeneric status, but in subsequent publications (Smith, 1978, 1981) he again recognized *Cephalopholis* as a valid genus. Recognition of *Cephalopholis* as either a genus or subgenus is a moot point, and (as pointed out by Smith-Vaniz et al., 1988) the monophyly of this genus has yet to be demonstrated. Nevertheless, *Cephalopholis* is a convenient taxon that is readily separable from other genera of groupers. Species of *Cephalopholis* have only IX dorsal-fin spines, whereas species of *Alphestes*, *Dermatolepis*, *Mycteroperca*, *Triso*, and *Epinephelus* have XI dorsal-fin spines (except for 3 species of *Epinephelus* which have X dorsal-fin spines and *E. acanthistius* of the eastern Pacific which has only IX dorsal-fin spines). Another useful generic character separating *Cephalopholis* and *Epinephelus* may be the presence of 3 to 6 trisegmental pterygiophores in the dorsal fin of *Cephalopholis* species (radiographs of 21 species examined, including *C. igarashiensis* and *C. polleni*). All of the *Epinephelus* that we have x-rayed (48 spp.) have only bisegmental pterygiophores (the middle piece being fused with the proximal element) supporting the dorsal- and anal-fin rays. Although only a few larvae of each genus are known, Leis (1986) has found that preflexion larvae of at least 6 species of *Cephalopholis* have a ventral series of 15 to 23 small melanophores on the tail. In postflexion larvae, the ventral melanophores are reduced to 1 to 4 and shift to a midlateral position on the peduncle. By contrast, *Epinephelus* preflexion larvae of at least 7 species have a single large ventral melanophore on the tail, and this shifts to the midlateral position on the peduncle in postflexion larvae. Differences between *Cephalopholis* and the other genera with species having IX dorsal-fin spines are discussed under those genera. According to C.L. Smith (1966) the genus *Menephorus* Poey, 1871 (type species, *Serranus dubius* Poey, 1860) was based on a specimen that appears to be a hybrid of *Paranthias furcifer* and *Cephalopholis fulva*. The genera *Uriphaeton* Swainson, 1839 and *Phaetonichthys* Bleeker, 1874 were based on the spurious species, *Uriphaeton microleptes* Swainson, 1839 and *Serranus phaeton* Valenciennes, 1828 respectively; and these two species are objective synonyms based on the hoax specimen (MNHN 7173) concocted from the body of a *Cephalopholis* and the tail of a cornetfish (*Fistularia*).

Key to the Western Atlantic Species of *Cephalopholis*

1a. Caudal fin well rounded; anal-fin rays 8; pectoral-fin rays 16; head, body, and fins pale grey, brown, or olive green, covered with orange-brown or reddish spots; 4 distinct spots, which can change rapidly from black to white or back again, on body at base of dorsal fin (Fig. 48, Plate II) (Caribbean, Gulf of Mexico) . . . . *C. cruentata*

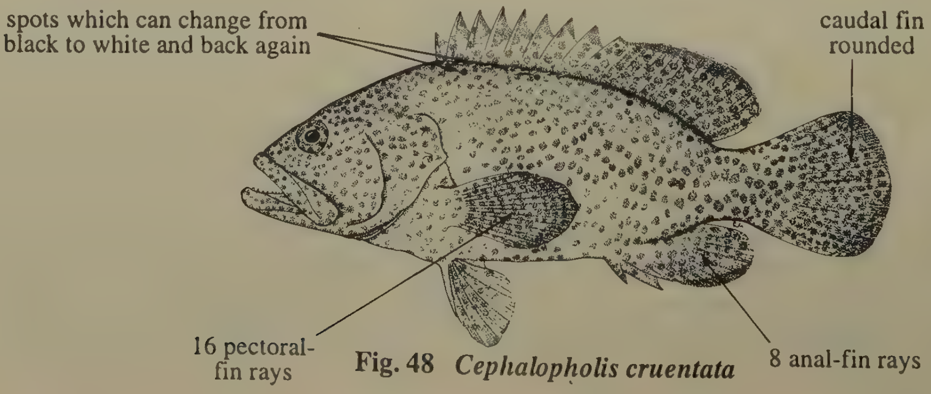

spots which can change from black to white and back again
caudal fin rounded
16 pectoral-fin rays
8 anal-fin rays

Fig. 48 *Cephalopholis cruentata*

1b. Caudal fin convex posteriorly with sharp corners; anal-fin rays 9; pectoral-fin rays 17 to 19; two small black spots on top of caudal peduncle and another two at tip of lower jaw (Fig. 49, Plates II and III) (Caribbean, Gulf of Mexico, southern Brazil) . . . . *C. fulva*

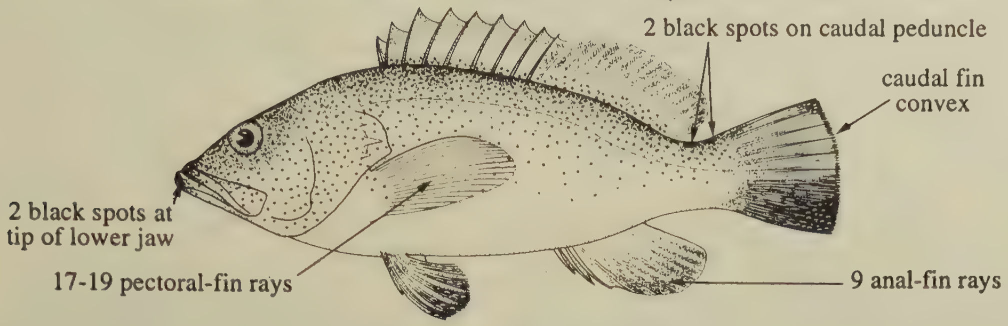

2 black spots on caudal peduncle
caudal fin convex
2 black spots at tip of lower jaw
17-19 pectoral-fin rays
9 anal-fin rays

Fig. 49 ***Cephalopholis fulva***

Key to the Eastern Atlantic Species of *Cephalopholis*

1a. Body dark brownish, with 3 or 4 indistinct dark bars posteriorly; anal-fin rays 8; lateral-line scales 45 to 50 (Fig. 50) (from Senegal to Angola) . . . . *C. nigri*

1b. Head, body, and median fins reddish orange, covered with small blue spots; anal-fin rays 9 or 10; lateral-line scales 68 to 72 (Fig. 51, Plate V) (from West Sahara to Angola) . . . *C. taeniops*

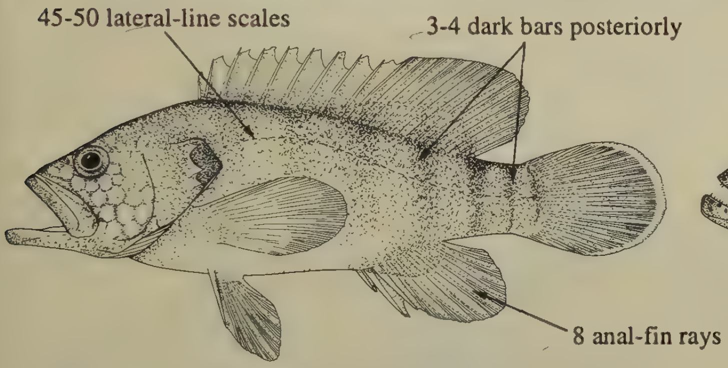

45-50 lateral-line scales
3-4 dark bars posteriorly
8 anal-fin rays

Fig. 50 ***Cephalopholis nigri***

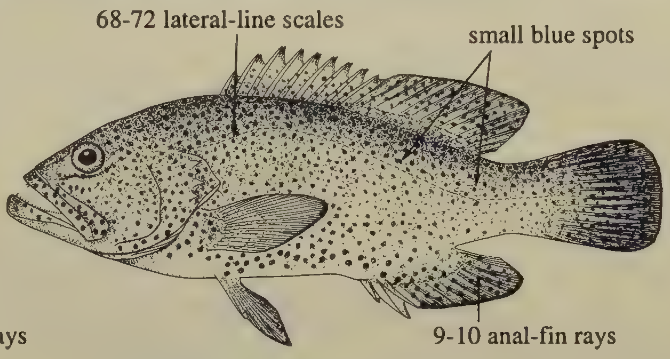

68-72 lateral-line scales
small blue spots
9-10 anal-fin rays

Fig. 51 ***Cephalopholis taeniops***

Key to Indo-Pacific and Red Sea Species of *Cephalopholis*:

1a. Caudal fin truncate to slightly emarginate; head small, 2.7 to 3.15 times in standard length; head and body with alternating stripes of blue and orange-yellow (Fig. 52, Plate IV) (islands of the west-central Pacific and Indian Ocean) . . . . *C. polleni*

1b. Caudal fin rounded; head length 2.2 to 2.7 times in standard length; colour pattern not of alternating stripes of blue and orange-yellow . . . . →2

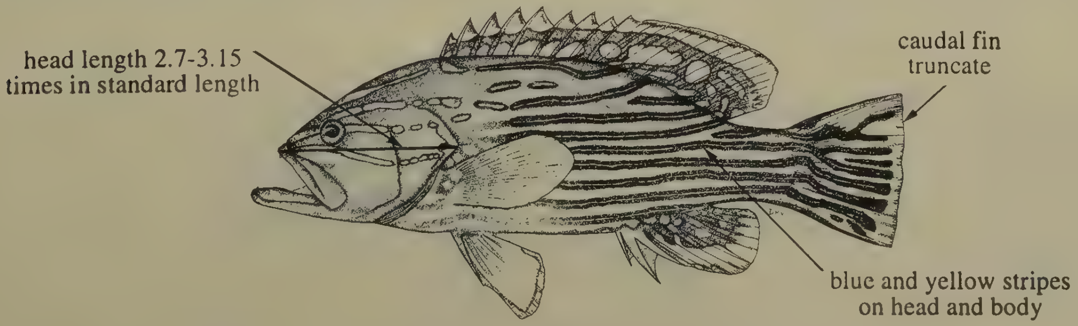

head length 2.7-3.15 times in standard length
caudal fin truncate
blue and yellow stripes on head and body

Fig. 52 ***Cephalopholis polleni***

2a. Body depth 2.0 to 2.4 times in standard length; body width 2.3 to 2.6 times in body depth; head and body red with yellow bars; pelvic-fin tips black; juveniles with large black spot in dorsal fin (Fig. 53, Plate III) (west-central Pacific) . . . . *C. igarashiensis*

2b. Body depth 2.3 to 3.2 times in standard length; body width 1.9 to 2.4 times in body depth; colour not as in 2a . . . . → *3*

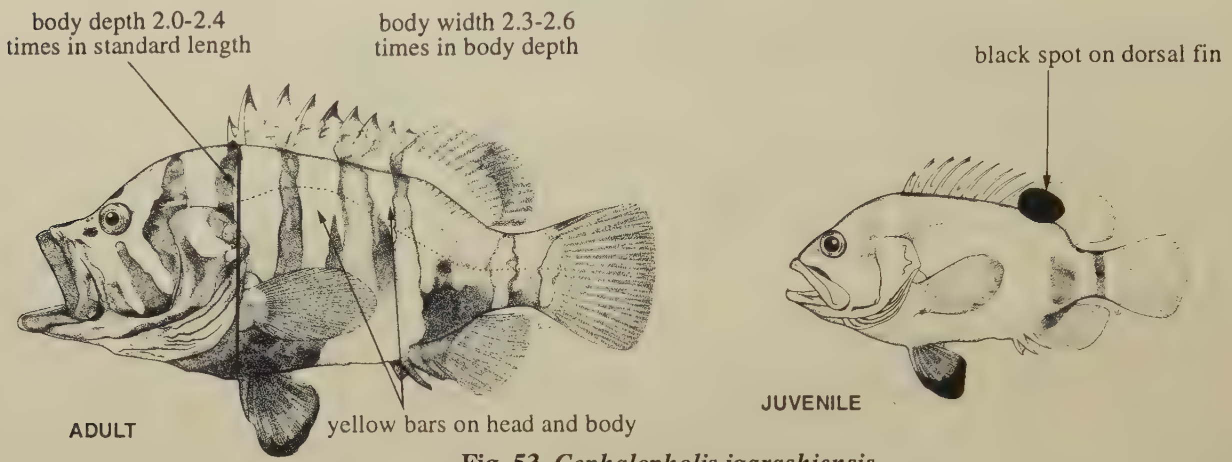

body depth 2.0-2.4 times in standard length
body width 2.3-2.6 times in body depth
black spot on dorsal fin
ADULT
yellow bars on head and body
JUVENILE

Fig. 53 ***Cephalopholis igarashiensis***

3a. Pelvic fins short, 2.3 to 2.45 times in head length; pectoral-fin rays 15 or 16 (rarely 16); dorsal-fin rays 14; anal-fin rays 8; colour generally reddish brown with an indistinct dark blotch basally on pectoral fins (Fig. 54, Plate I) (Indonesia, Philippines, and New Guinea). . *C. aitha*

3b. Pelvic-fin length 1.5 to 2.35 times in head length; pectoral-fin rays 15 to 20 (rarely 15); dorsal-fin rays 14 to 17; anal-fin rays 8 to 10; colour not as in 3a . . . . → *4*

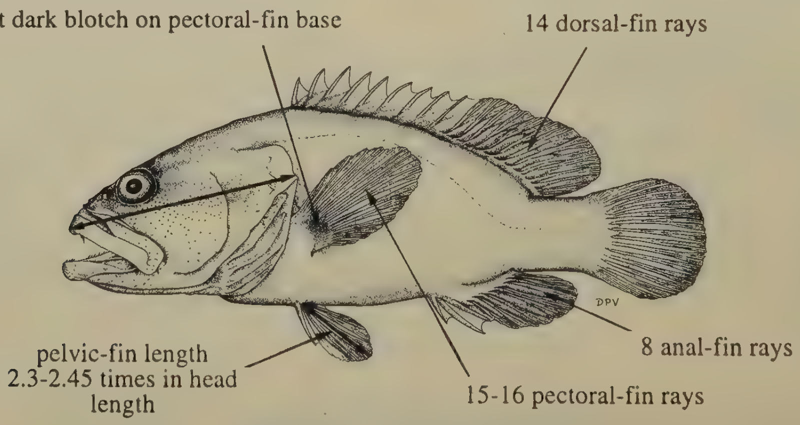

indistinct dark blotch on pectoral-fin base
14 dorsal-fin rays
DPV
8 anal-fin rays
pelvic-fin length 2.3-2.45 times in head length
15-16 pectoral-fin rays

Fig. 54 ***Cephalopolis aitha***

4a. Anal-fin rays usually 8; colour generally brown to dark brown . . . . → *5*

4b. Anal-fin rays 9 (rarely 10); colour generally red, orange or yellow (except *C. argus* and some *C. urodeta* or *C. sonnerati*) . . . . → *8*

5a. Small dark spots or dark-edged pale blue spots on head and/or body (except juveniles of *C. cyanostigma*, which are dark brown with bright yellow median fins) . . . . → *6*

5b. No small dark spots or blue ocelli on head or body . . . . → *7*

6a. Dorsal-fin rays usually 15; lateral-scale series 84 to 98; pectoral-fin length contained 1.4 to 1.6 times in head length; dark-edged blue spots only on head and anteriorly on body (Fig. 55, Plate III) (Andaman Sea, Philippines, and Indonesia to New Caledonia and Great Barrier Reef) . . . . *C. microprion*

6b. Dorsal-fin rays usually 16; lateral-scale series 92 to 106; pectoral-fin length 1.5 to 1.8 times in head length; blue ocelli on head, body, and basally on median fins (Fig. 56, Plate II) (Andaman Sea, Gulf of Thailand, Indonesia, Philippines, northern Australia, and New Britain) . . . . *C. cyanostigma*

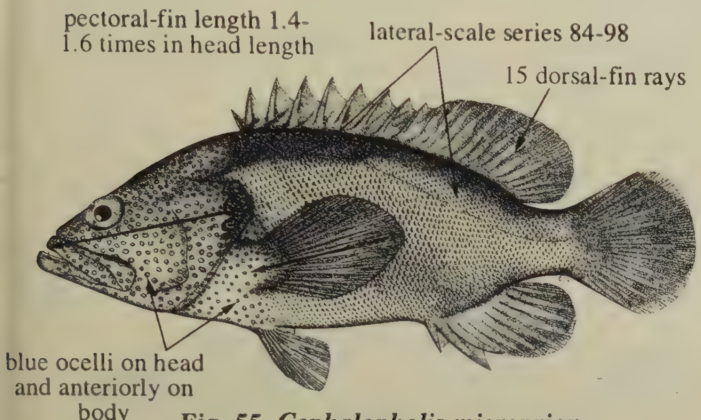

pectoral-fin length 1.4-1.6 times in head length
lateral-scale series 84-98
15 dorsal-fin rays
blue ocelli on head and anteriorly on body

Fig. 55 *Cephalopholis microprion*

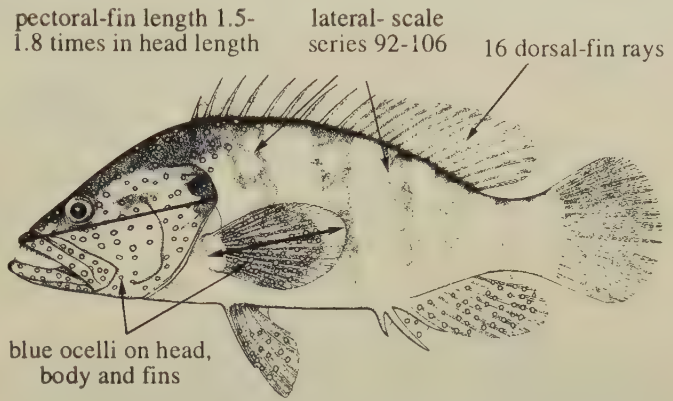

pectoral-fin length 1.5-1.8 times in head length
lateral- scale series 92-106
16 dorsal-fin rays
blue ocelli on head, body and fins

Fig. 56 *Cephalopholis cyanostigma*

7a. Pectoral fins short, their length contained 1.5 to 1.8 times in head length; colour generally brown or yellowish brown, with dark blue lines on head, body and fins (Fig. 57, Plate II) (west coast of India to western Pacific) . . . . *C. formosa*

7b. Pectoral fins 1.3 to 1.6 in head length; body brown, usually with 7 or 8 dark bars; no blue lines on head or body; fins dark brown, with a pale blue line at corners of caudal (Fig. 58, Plate II) (Indo-West Pacific) . . . . *C. boenak*

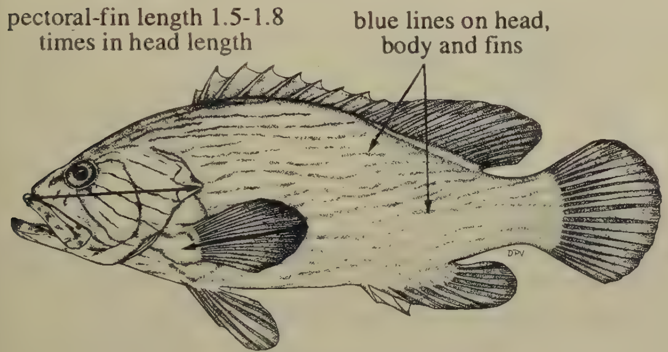

pectoral-fin length 1.5-1.8 times in head length
blue lines on head, body and fins
DPV

Fig. 57 *Cephalopholis formosa*

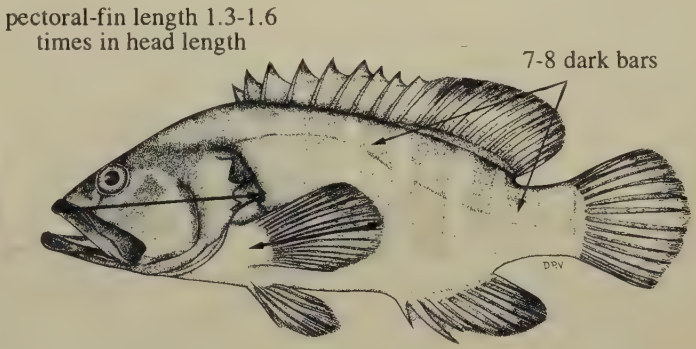

pectoral-fin length 1.3-1.6 times in head length
7-8 dark bars
DPV

Fig. 58 *Cephalopholis boenak*

8a. Dorsal-fin rays 15 to 17; lower-limb gill rakers 17 to 19; auxiliary scales present on body; colour dark brown, covered with small dark-edged blue ocelli; 5 or 6 pale bars often visible on rear half of body (Fig. 59, Plate I) (Red Sea and Indo-Pacific) . . . . *C. argus*

8b. Dorsal-fin rays usually 14 or 15; lower-limb gill rakers 13 to 16; no auxiliary scales on body scales; colour not as in 8a. . . . . → *9*

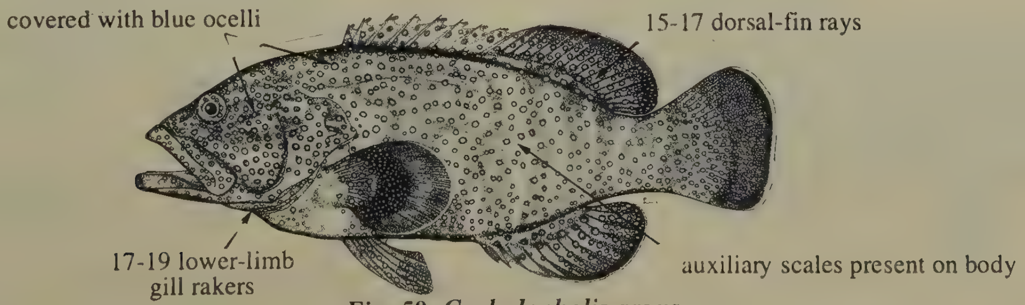

covered with blue ocelli
15-17 dorsal-fin rays
17-19 lower-limb gill rakers
auxiliary scales present on body

Fig. 59 *Cephalopholis argus*

9a. Ventral edge of preopercle serrate; colour orange-red in life with widely scattered pale blue spots on body and fins and elongate spots or short lines on head (Fig. 60, Plate IV) (Red Sea). . . . . *C. oligosticta*

9b. Ventral edge of preopercle smooth and usually covered by skin (except *C. sonnerati* with a few serrae posteriorly); colour not as in 9a . . . . → *10*

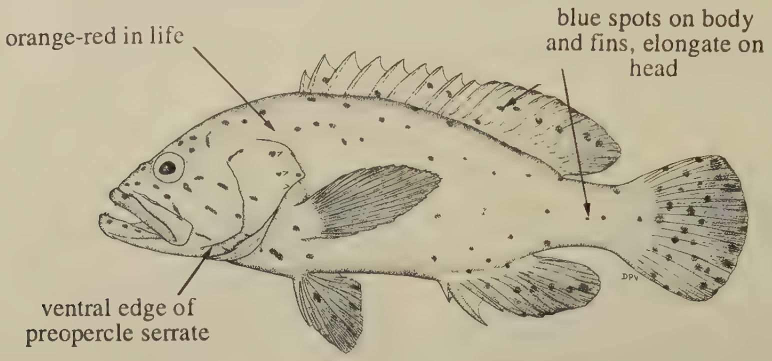

orange-red in life
blue spots on body and fins, elongate on head
ventral edge of preopercle serrate
DPV

Fig. 60 *Cephalopholis oligosticta*

10a. Lateral-line scales 66 to 80; lateral-scale series 115 to 134; pectoral-fin rays 18 to 20; body depth 2.3 to 2.8 times in standard length; colour generally red to reddish brown (juveniles and some adults may be dark purple or brown) with widely scattered whitish blotches (Indian Ocean) or generally brownish, covered with small dark red to reddish brown spots and irregular white blotches (Pacific) (Fig. 61, Plate V) (tropical Indian Ocean and Pacific) . . . . *C. sonnerati*

10b. Lateral-line scales 45 to 68; lateral-scale series 79 to 121; pectoral-fin rays 16 to 19; body depth 2.6 to 3.5 times in standard length; colour not as in 10a . . . . → *11*

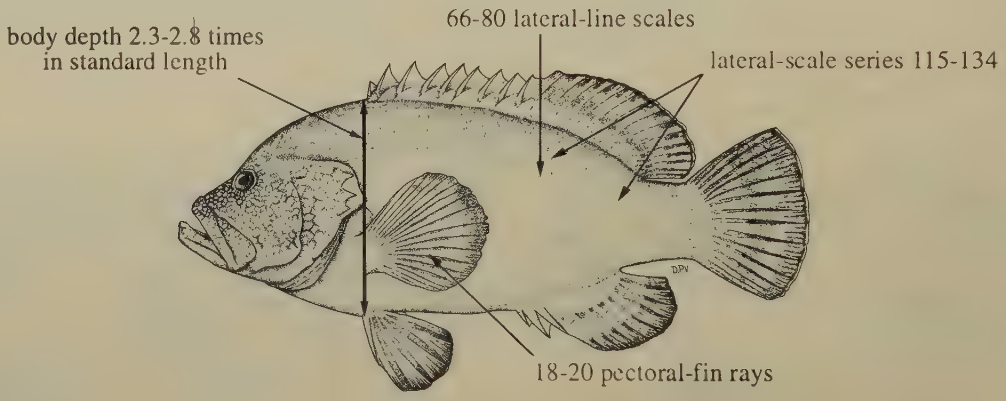

body depth 2.3-2.8 times in standard length
66-80 lateral-line scales
lateral-scale series 115-134
18-20 pectoral-fin rays
DPV

Fig. 61 *Cephalopholis sonnerati*

11a. Lateral-line scales 54 to 68; caudal fin blackish red, the corners broadly red, each set off by an oblique white stripe; pectoral fins red, shading to orange-yellow distally (Pacific); or caudal and pectoral fins uniformly blackish (Indian Ocean) (Fig. 62, Plate V and VI) . . . . *C. urodeta*

11b. Lateral-line scales 45 to 56; colour not as in 11a . . . . → *12*

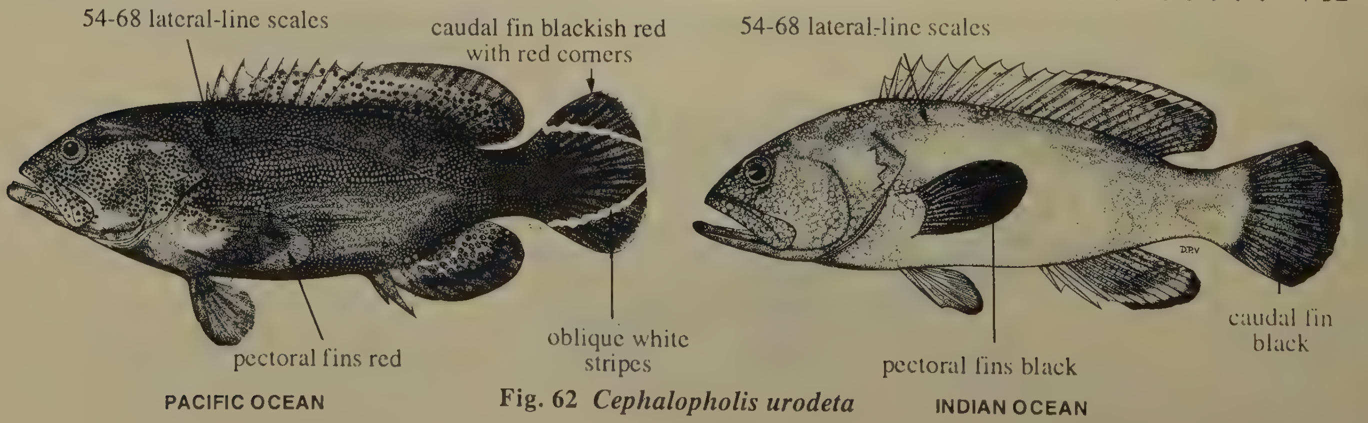

54-68 lateral-line scales
caudal fin blackish red with red corners
54-68 lateral-line scales
pectoral fins red
oblique white stripes
pectoral fins black
caudal fin black
DPV
PACIFIC OCEAN
INDIAN OCEAN

Fig. 62 *Cephalopholis urodeta*

12a. Lateral-scale series 79 to 88; head length 2.2 to 2.4 times in standard length; dark brown saddle spot on caudal peduncle, followed by a smaller spot; oblique dark streak on caudal fin (Fig. 63, Plate III) (Indo-Pacific). . . . . *C. leopardus*

12b. Lateral-scale series 90 to 121; head length 2.3 to 2.6 times in standard length; colour not as in 12a . . . . → *13*

13a. Dorsal-fin rays usually 14; caudal fin and rear part of dorsal and anal fins blackish; numerous small blue ocelli on lower part of head and body, but few dorsally (Fig. 64, Plate III) (Red Sea to Persian Gulf and Pakistan) . . . . *C. hemistiktos*

13b. Dorsal-fin rays usually 15; median fins not blackish; small blue spots, if present, uniformly distributed on head and body. . . . . → *14*

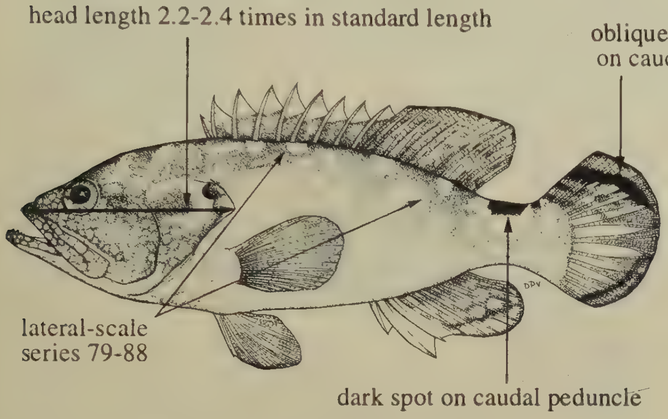

head length 2.2-2.4 times in standard length
oblique streak on caudal fin
lateral-scale series 79-88
dark spot on caudal peduncle
DPV

Fig. 63 *Cephalopholis leopardus*

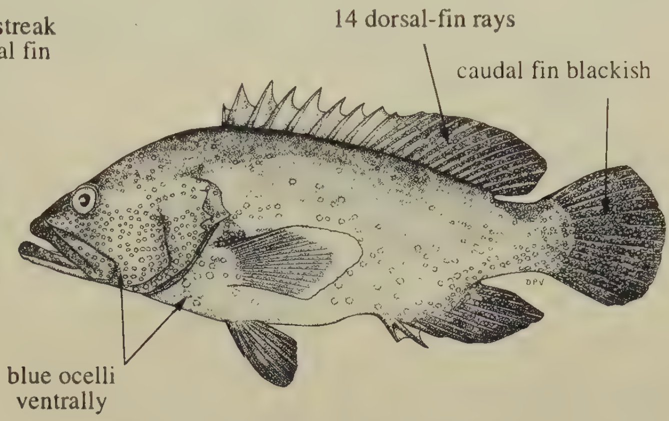

14 dorsal-fin rays
caudal fin blackish
blue ocelli ventrally
DPV

Fig. 64 *Cephalopholis hemistiktos*

14a. Head, body, and fins covered with small blue ocelli . . . . → *15*

14b. No blue spots on head, body, or fins . . . . → *16*

15a. Body with 4 or 5 quadrangular dark brown or black blotches along base of dorsal fin, another faint blotch on nape and 2 smaller ones on peduncle (blotches sometimes merging with dark red vertical bars); most specimens with dark-edged blue lines radiating from eyes (Fig. 65, Plate IV) (Red Sea and Indo-Pacific). . . . . *C. sexmaculata*

15b. No dark blotches dorsally on body; no blue lines radiating from eyes (Fig. 66, Plate IV) (Red Sea and Indo-Pacific) . . . . *C. miniata*

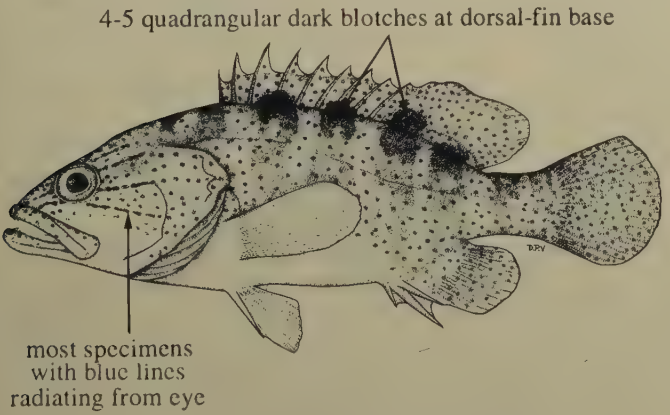

4-5 quadrangular dark blotches at dorsal-fin base
most specimens with blue lines radiating from eye
DPV

Fig. 65 *Cephalopholis sexmaculata*

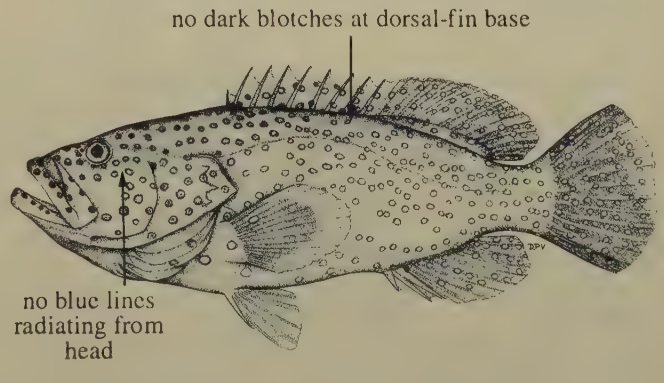

no dark blotches at dorsal-fin base
no blue lines radiating from head
DPV

Fig. 66 *Cephalopholis miniata*

16a. Edge of subopercle and interopercle distinctly serrate; pelvic fins usually reaching anus, pelvic-fin length 1.6 to 2.0 times in head length; colour generally orange-yellow to orange-red or golden, with red to orange dots on head and dorsally on body (Fig. 67, Plate I) (Indo-Pacific) . . . . ***C. aurantia***

16b. Subopercle and interopercle usually smooth (rarely with a few small serrae); pelvic fins not reaching anus, pelvic-fin length 1.9 to 2.2 times in head length; colour reddish orange, mottled with dark red or brownish red (Fig. 68, Plate V) (Indo-Pacific). . . . . ***C. spiloparaea***

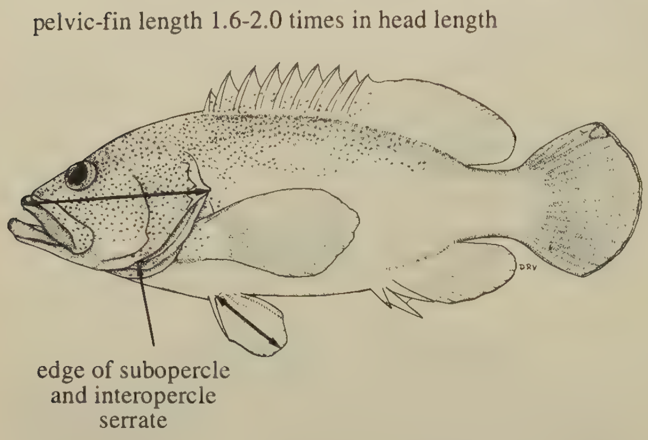

pelvic-fin length 1.6-2.0 times in head length
edge of subopercle and interopercle serrate
DRV

Fig. 67 ***Cephalopholis aurantia***

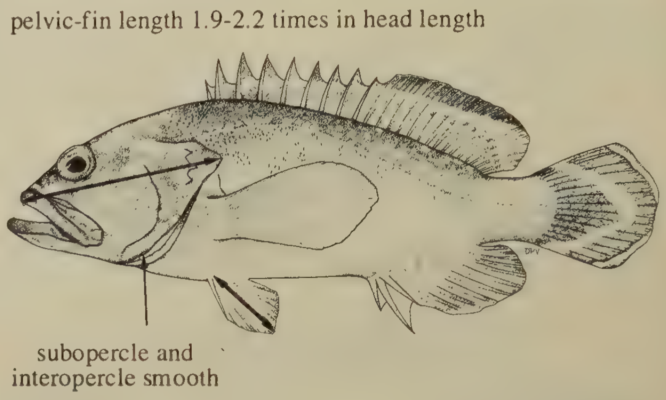

pelvic-fin length 1.9-2.2 times in head length
subopercle and interopercle smooth
DRV

Fig. 68 ***Cephalopholis spiloparaea***

Cephalopholis aitha Randall and Heemstra, 1991

Fig. 69; Pl. ID

SERRAN Cephal 22

Cephalopholis aitha Randall and Heemstra, 1991:29, pl. 1c, figs 5-6 (type locality: Nagada Harbor, Madang, Papua New Guinea).

Synonyms: None.

FAO Names: **En** - Rusty hind; **Fr** - Vielle rouillé; **Sp** - Cherna herrumbrosa.

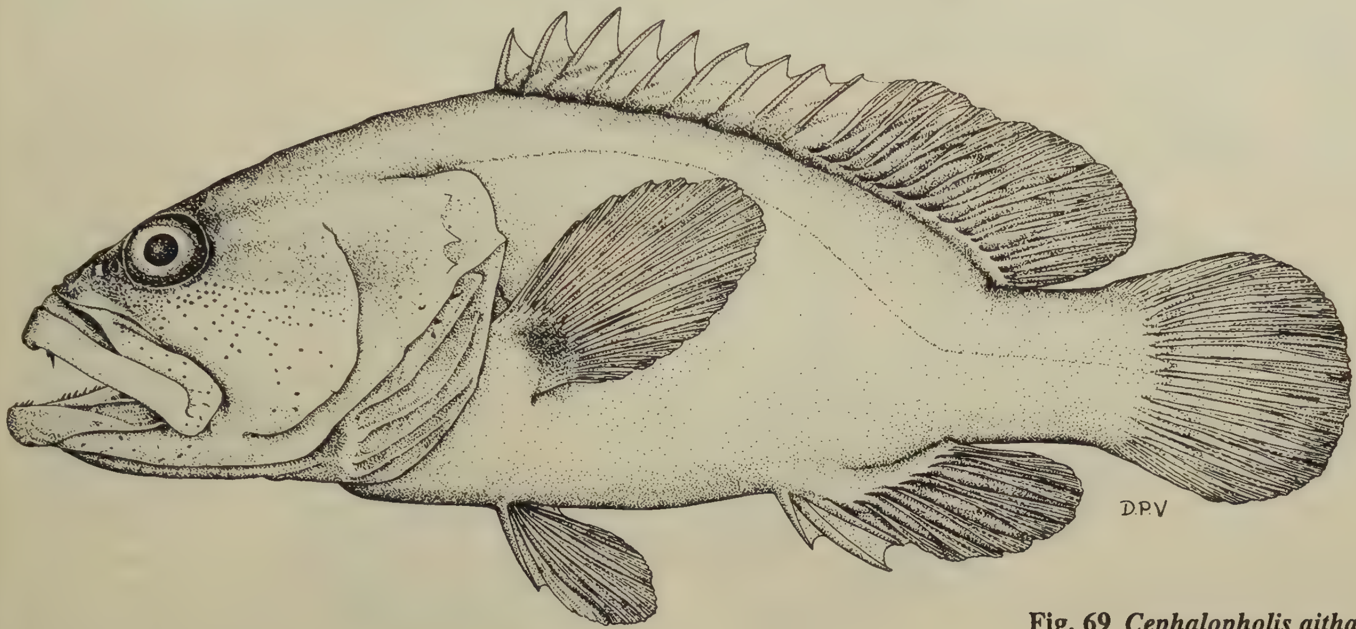


Fig. 69 ***Cephalopholis aitha***
(125 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 2.9 times in standard length. Head length contained 2.1 to 2.3 times in standard length; preopercle rounded, the posterior edge finely serrate, the lower edge fleshy; upper edge of operculum very convex; maxilla extends past eye; teeth noticeably large. Gill rakers 8 to 9 on upper limb and 16 to 19 on lower limb. Dorsal fin with IX spines and 14 rays; anal fin with III spines and 8 rays; pectoral-fin rays 15 or 16; pelvic-fin length contained 2.3 to 2.45 times in head length. Midlateral-body scales ctenoid; lateral-line scales 46 to 49; lateral-scale series 82 to 99. **Colour:** Reddish, the edges of dorsal body scales dark brown; snout dark brown; postorbital head with pale blue network; pale blue line along rear edge of orbit; upper jaw and cheeks with scattered pale blue dots and short lines; fins reddish; margin of soft dorsal, anal, and caudal fins pale bluish.

Geographic Distribution: Papua New Guinea, Indonesia (Sulawesi, Flores), and the Philippines (Fig. 70).

Habitat and Biology: *C. aitha* has been found in protected or silty reef areas at depths of 5 to 33 m.

Size: Attains 14 cm standard length.

Interest to Fisheries: None.

Local Names:

Literature: Randall and Heemstra (1991).

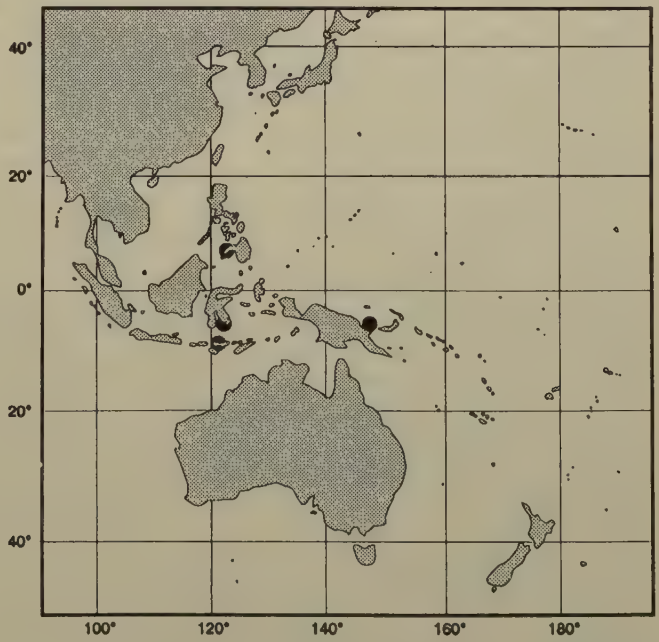


Fig. 70

Cephalopholis argus Bloch and Schneider, 1801

Fig. 71; Pl. IE

SERRAN Cephal 9

Cephalopholis argus Bloch and Schneider, 1801:311, pl. 61 (type locality: East Indies).

Synonyms: *Bodianus guttatus* Bloch, 1790:36, pl. 224 (type locality: "Japan"; preoccupied in *Epinephelus* by *Perca guttata* Linnaeus, 1758; placed on Official List of Rejected and Invalid Specific Names in Zoology [International Commission on Zoological Nomenclature, 1987, Opinion 1439]). *Bodianus jacob-evertsen* Lacepède, 1802:296 (in part). *Serranus myriaster* Valenciennes in Cuv. and Val., 1828:365 (type locality: Bora Bora). ?*Serranus immunerur* Thiollière, 1857:144 (type locality: Woodlark Island).

FAO Names: **En** - Peacock hind; **Fr** - Vielle la pruda; **Sp** - Cherna pavo real.

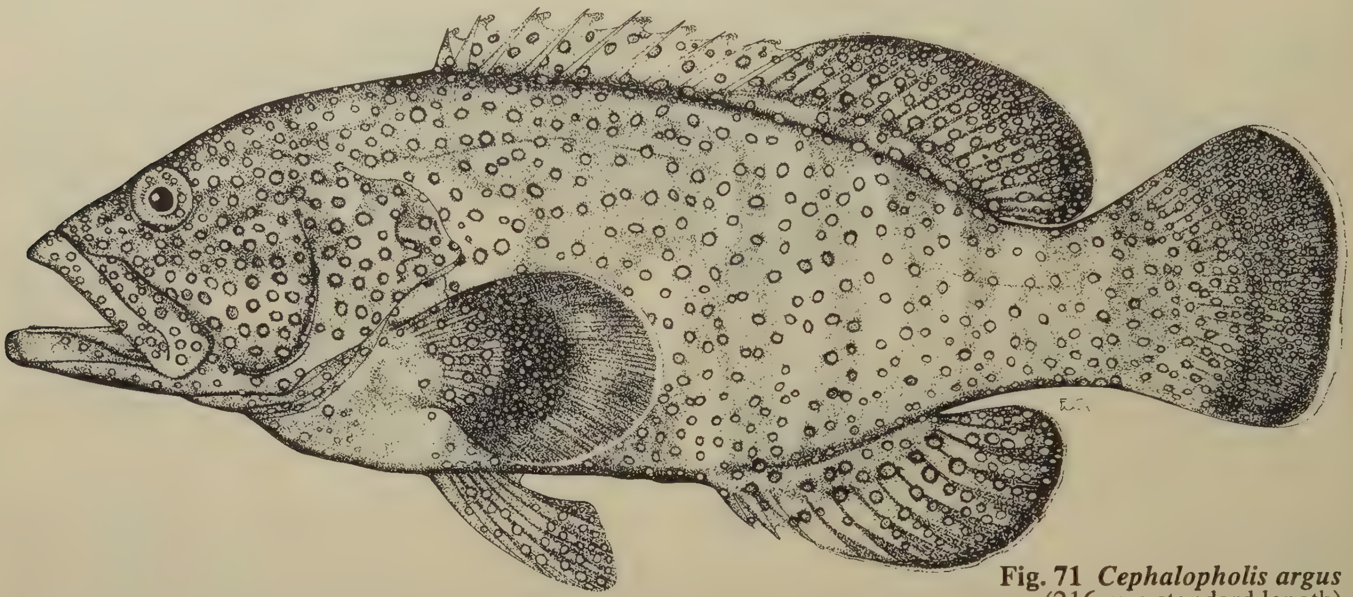


Fig. 71 *Cephalopholis argus*
(216 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, body depth contained 2.7 to 3.2 times in standard length (for fish 10 to 40 cm standard length). Head length contained 2.4 to 2.7 times in standard length; eye small, its diameter distinctly less than snout length; interorbital area flat to slightly convex; preopercle rounded, finely serrate in young, virtually smooth in large adults, the lower edge fleshy; subopercle and interopercle smooth, maxilla scaly, reaching well past eye. Gill rakers 9 to 11 on upper limb, 17 to 19 on lower limb, the rudimentary rakers on lower limb difficult to distinguish from intercalated bony plates. Dorsal fin with IX spines and 15 to 17 rays, the membranes indented between the spines; anal fin with III spines and 9 rays; pectoral-fin rays 16 to 18; pectoral fins clearly longer than pelvic fins, pectoral-fin length contained 1.4 to 2.0 times in head length; pelvic fins not reaching anus, their length contained 1.9 to 2.4 times in head length; caudal fin well rounded. Lateral-body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 46 to 51; lateral-scale series 95 to 110. **Colour**: Dark brown, covered with small black-edged blue ocelli; often with 5 or 6 pale bars on rear part of body and a large pale area over the chest; posterior margin of median fins usually with a narrow white edge; distal part of pectoral fins sometimes maroon brown; triangular membranes at tips of dorsal-fin spines orange-gold.

Geographical Distribution: *C. argus* is the most widely distributed of the groupers, occurring from the Red Sea to South Africa and east to French Polynesia and the Pitcairn group, including northern Australia, Lord Howe Island, and Japan. Recently introduced to the Hawaiian Islands (Fig. 72).

Habitat and Biology: A common tropical species found in a variety of coral reef habitats from tide pools to depths of at least 40 m. In the Gulf of Aqaba, *C. argus* is found in social units comprising up to

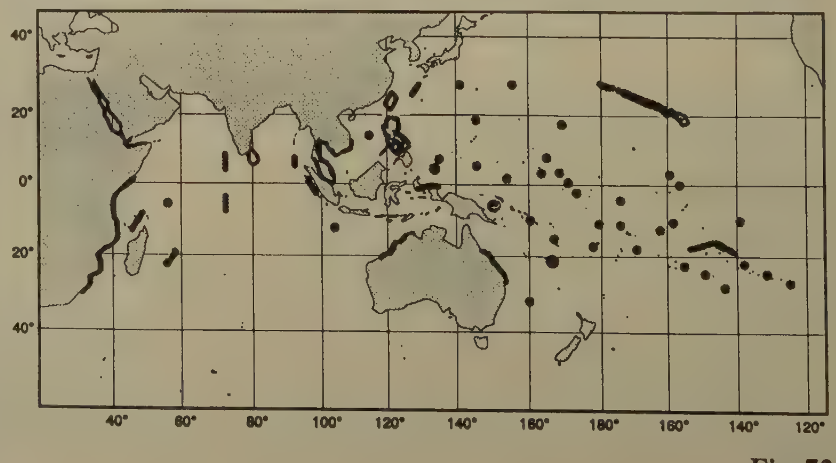


Fig. 72

12 adults, including one dominant male. Each group occupies a specific area (up to 2 000 m^2) that is defended by the territorial male and subdivided into secondary territories, each inhabited by a single female (Shpigel and Fishelson, 1989b, 1991). The preferred habitat of *C. argus* is the 1 to 10 m reef zone. Primarily (75 to 95%) piscivorous, *C. argus* has been blamed for numerous cases of ciguatera in the Pacific region. In the Red Sea, Shpigel and Fishelson (1989a) found that this species feeds mainly in the early morning and late afternoon; but at Madagascar (Harmelin-Vivien and Bouchon, 1976), it appears to feed more at night.

Size: Maximum total length 55 cm.

Interest to Fisheries: This common and widespread species is important to artisanal fisheries throughout the Indo-West Pacific region. Caught with hook-and-line, spear, and with traps.

Local Names: COMORO ISLANDS: Shenbandro; INDIA: Balufana (Lakshadweep Islands); JAPAN: Aonomehata; KENYA: Chewa (Swahili); MADAGASCAR: Alovo; MAURITIUS: Vielle cuisnier; PALAU: Mengardelucheb, Mengardeluu, Mardelucheb; SEYCHELLES: Vielle cecille; SINGAPORE: Kerapu bunga; SOMALIA: Summan, Mushenzi; TAHITI: Roi; TANZANIA: Chewa (Swahili).

Literature: Randall and Brock (1960); Morgans (1982); Randall and Ben-Tuvia (1983); Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Remarks: *C. argus* has been confused with *C. cyanostigma*, which has a generally similar colour pattern of small blue ocelli on a dark brown or reddish background. *C. cyanostigma* differs in having the pectoral fins yellow-orange at least distally, with a black margin and blue spots only proximally; also, the body often has pale spots containing 1 to 3 small blue spots and 5 or 6 chain-like dark bars. In addition to these differences in colour pattern, *C. cyanostigma* has only 8 anal-fin rays and fewer gill rakers (7 to 9 on upper limb and 14 to 18 on lower limb).

Cephalopholis aurantia (Valenciennes, 1828)

Fig. 73; Pl. IF

SERRAN Cephal 10

Serranus aurantius Valenciennes in Cuv. and Val., 1828:305 (type locality: Seychelles).

Synonyms: ***Serranus analis*** Valenciennes in Cuv. and Val., 1828:307 (type locality: New Ireland). ?***Serranus rufus*** Hombron and Jacquinot in Jacquinot and Guichenot, 1853:35, pl. 1, fig. 4 (locality unknown). ***Epinephelus miltostigma*** Bleeker, 1874:43 (type locality: Amboina [Ambon, Indonesia]). ***Bodianus indelebilis*** Fowler, 1904:521, Pl. 12, lower fig. (type locality: Sumatra). ***Cephalopholis obtusauris*** Evermann and Seale, 1907a:77, fig. 12 (type locality: Bacon, Sorsogon, Philippines).

FAO Names: **En** - Golden hind; **Fr** - Vielle dorée; **Sp** - Cherna dorada.

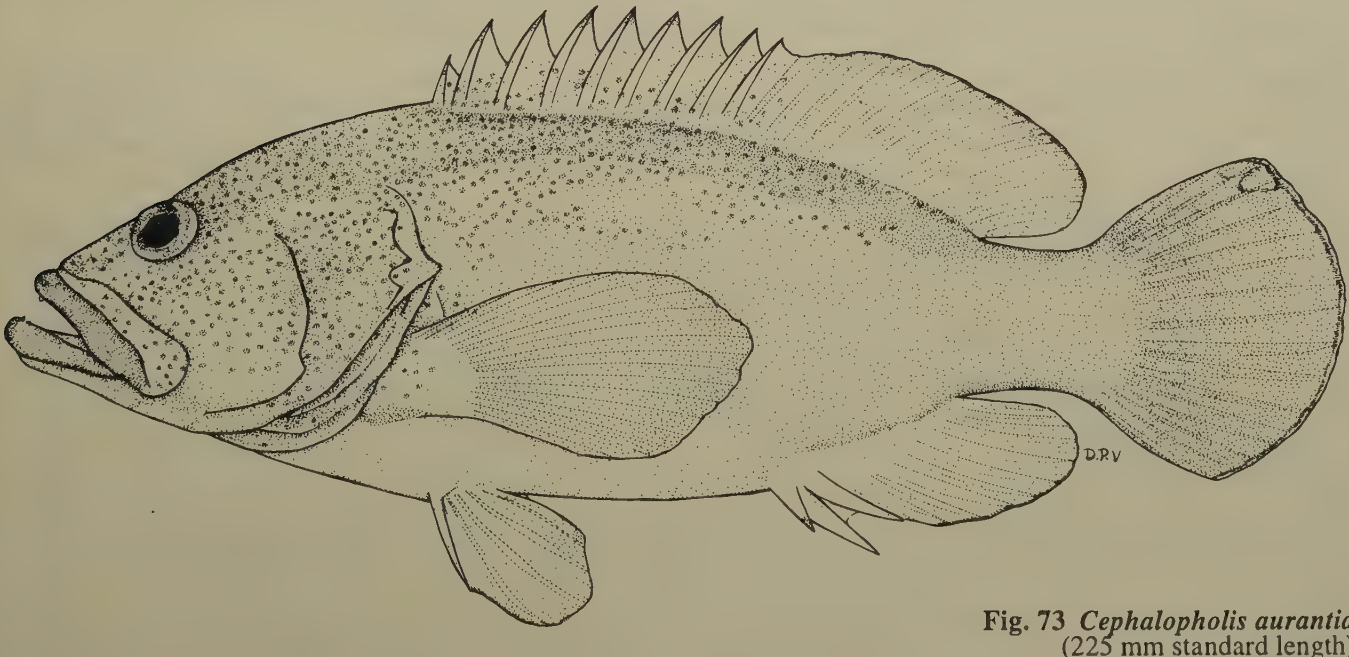


Fig. 73 *Cephalopholis aurantia* (225 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.6 to 2.9 times in standard length (for fish 12 to 22 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle serrate; maxilla scaly, reaching to or beyond vertical at rear edge of eye. Gill rakers 7 to 9 on upper limb, 14 to 17 on lower limb. Dorsal fin with IX spines and 14 to 16 rays, the membranes distinctly incised between the spines; anal fin with III spines and 9 (rarely 8) soft rays; pectoral-fin rays 17 to 19; pectoral fins distinctly longer than pelvic fins, pectoral-fin length contained 1.3 to 1.5 times in head length; pelvic fins reach to or slightly short of anus, their length contained 1.6 to 2.0 times in head length; caudal fin well rounded. Lateral-body scales ctenoid; lateral-line scales 47 to 53; lateral-scale series 94 to 121. **Colour:** Pale orange-red to orange-yellow or golden with red or yellow dots on head, anterodorsally on body, and on base of dorsal fin. Posterior margin of caudal fin with a pale blue edge and black submarginal line; posterior parts of dorsal and anal fins often with a narrow pale blue edge.

Geographical Distribution: South Africa and islands of the western Indian Ocean to the central Pacific and Japan (Fig. 74). Except for a single specimen caught off the coast of Natal, South Africa, we know of no confirmed records from continental localities. The report of *C. aurantia* from east Africa (Morgans, 1982) is based on misidentifications of *C. nigripinnis*.

Habitat and Biology: *C. aurantia* is a deep-water grouper usually caught in depths over 100 m. Specimens are rare in museums.

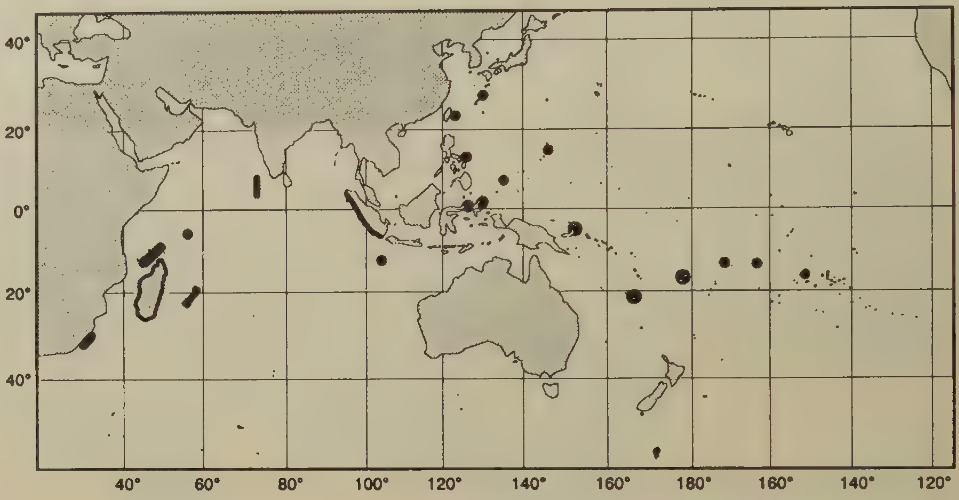


Fig. 74

Size: Maximum total length probably about 30 cm; the maximum size of 60 cm given by Heemstra and Randall (1984, 1986) is probably an exaggeration.

Interest to Fisheries: Because of its small size and occurrence in moderately deep water, *C. aurantia* is of little commercial importance as a food fish.

Local Names: JAPAN: Hana-hata; MAURITIUS: Mama rouge; SEYCHELLES: Maconde.

Literature: Heemstra and Randall (1984, 1986); Randall and Heemstra (1991).

Remarks: *C. aurantia* is similar to *C. spiloparaea*, which differs in colour (generally pale reddish, mottled and blotched with dark red or brownish red) and usually has shorter pelvic fins (not reaching anus, their length 1.9 to 2.2 times in head length). *C. sonnerati* differs in colour pattern and in having a greater body depth (2.3 to 2.7 times in standard length) and more numerous scales (lateral-line scales 66 to 80).

Randall (1986, 1987a) recognized *C. analis* of the central and western Pacific as distinct from the closely related *C. aurantia* of the western Indian Ocean. Indian Ocean fish have a black submarginal line in the caudal fin and were thought to have more gill rakers and more rounded dorsal and anal fins than specimens from the Pacific. Examination of additional specimens, including a series of 4 fish from Christmas Island in the eastern Indian Ocean, has shown that the number of gill rakers and the shape of the dorsal and anal fins are not significantly different in these two populations. In view of the great similarity in the morphology and colour patterns of fish from the Indian and Pacific Oceans, Randall and Heemstra (1991) synonymized these two nominal species.

The account of "*Cephalopholis analis*" by Heemstra and Randall (1984) in the *FAO Species Identification Sheets for the Western Indian Ocean* (Fischer and Bianchi, 1984) is a misidentification of *C. spiloparaea*.

Cephalopholis boenak (Bloch, 1790)

Fig. 75; Pl. IIA

SERRAN Cephal 11

Bodianus boenak Bloch, 1790:43, pl. 226 (type locality: "Japan" [probably Java, as indicated by the native name that Bloch used for this species]; spelt "***boenack***" on the plate).

Synonyms: ***Serranus pachycentron*** Valenciennes in Cuv. and Val., 1828:295 (locality unknown). ?***Serranus boelang*** Valenciennes in Cuv. and Val., 1828:308 (type locality: East Indies). ***Serranus stigmapomus*** Richardson, 1846:232 (type locality: Canton, China). ***Serranus nigrofasciatus*** Hombron and Jacquinot in Jacquinot and Guichenot, 1853:36, pl. 2, fig. 1 (locality unknown).

FAO Names: **En** - Chocolate hind; **Fr** - Vielle chocolat; **Sp** - Cherna chocolate.

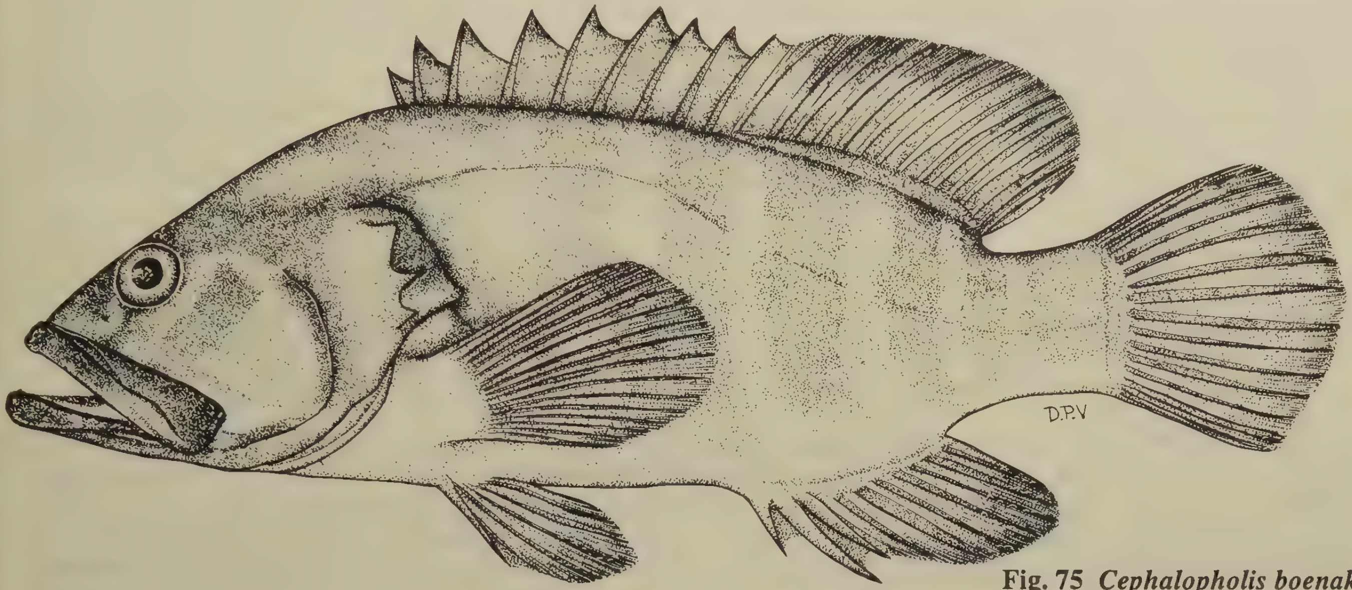


Fig. 75 *Cephalopholis boenak* (204 mm standard length)

Diagnostic Features: Body depth less than head length, body depth contained 2.6 to 3.0 times in standard length (for fish 10 to 19 cm standard length). Head length contained 2.3 to 2.7 times in standard length; preorbital depth usually less than half maxilla width, 2.5 to 3.6% of standard length; interorbital area flat; preopercle rounded, very finely serrate; no enlarged spines at angle, the lower edge fleshy; subopercle and interopercle weakly serrate; maxilla naked, reaching about to vertical at rear edge of eye. Gill rakers 7 to 9 on upper limb, 14 to 17 on lower limb. Dorsal fin with IX spines and 15 to 17 rays; the membranes indented between the spines; anal fin with III spines and 8 rays, the second spine 15 to 18% of standard length, reaching past tip of third spine; pectoral-fin rays 16 or 17; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.3 to 1.6 times in head length; pelvic fins usually reaching to or beyond anus, pelvic-fin length contained 1.7 to 2.2 times in head length; caudal fin well rounded. Body scales ctenoid, without auxiliary scales; lateral-line scales 46 to 51; lateral-scale series 86 to 100. **Colour**: Dark brown (occasionally dark reddish brown), usually with 7 or 8 dark bars on body; some fish with dark brown bands radiating from eye; black spot between upper and middle opercular spines; soft dorsal, anal, and caudal fins darker distally, with a pale bluish line on the edge (except central part of caudal fin).

Geographical Distribution: *C. boenak* is primarily continental in its distribution, occurring from Kenya to southern Mozambique and eastward to the western Pacific (Ryukyu Islands Taiwan, China, Philippines, Indonesia, Papua New Guinea, New Caledonia, and eastern Australia) (Fig. 76). It has not been reported from oceanic islands in the Indian Ocean, except for Aldabra, Madagascar, and the Comoro, Andaman, and Lakshadweep islands. The record from the Seychelles (Smith and Smith, 1963) is apparently erroneous, the illustrated fish being from Delagoa Bay (Mozambique). It is not known from the Red Sea, Persian Gulf, nor the islands of Micronesia or Polynesia, except for Palau.

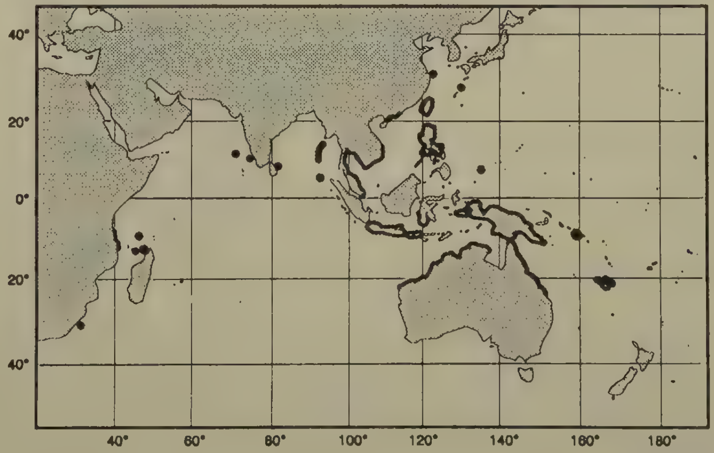


Fig. 76

Habitat and Biology: *C. boenak* is usually found in 4 to 30 m on silty dead reefs in protected waters; also taken in trawls to depths of 64 m. According to Myers (1989), it feeds primarily on crustaceans. Donaldson (1989) observed courtship and pair spawning at Papua New Guinea.

Size: Maximum total length 26 cm.

Interest to Fisheries: *C. boenak* is too small to be of commercial importance. Caught with hook-and-line, traps, and in trawls.

Local Names: HONG KONG: Woo-sze, Brown coral cod; SINGAPORE: Shi-hou.

Literature: Chan (1968); Morgans (1982); Heemstra and Randall (1984, 1986).

Remarks: Before 1984, most authors referred to this species as *C. pachycentron*, and the name *C. boenak* (usually spelt *boenack*) was erroneously applied to the bluelined hind (*C. formosa*). The latter differs in colour pattern and in having a shorter second anal-fin spine (12.0 to 14.6% of standard length, not reaching past tip of third spine) and the preorbital depth is more than half of the maxilla width. The holotype of *Serranus boelang* Valenciennes, 1828 is not (as listed by Bauchot et al., 1984) in the Muséum National d'Histoire Naturelle in Paris; it is a dry stuffed specimen, 142 mm standard length (RMNH 120) in the Rijksmuseum van Natuurlijke Historie, Leiden and appears to be a specimen of *C. boenak*.

Cephalopholis cruentata (Lacepède, 1802)

Fig. 77; Pl. IIB

SERRAN Cephal 4

Sparus cruentatus Lacepède, 1802, 2:156, pl. 4, fig. 1 (based on *Perca guttata* Linnaeus [Gmelin edition]).

Synonyms: *Serranus coronatus* Valenciennes in Cuv. and Val., 1828:371 (substitute name for *Perca guttatus* Bloch, 1792:89, pl. 312 = *Sparus cruentatus* Lacepède, 1802:157, pl. 4, fig. 1; type locality: Martinique). *Serranus nigriculus* Valenciennes in Cuv. and Val., 1828:375 (type localities: Martinique and Dominican Republic). *Serranus apiarius* Poey, 1860:143 (type locality: Cuba). *Bodianus stellatus* Blosser, 1909:297 (type locality: St. Croix). Also many references under the names *Petrometopon cruentatus* or *Epinephelus cruentatus*.

FAO Names: **En** - Graysby; **Fr** - Coné essaim; **Sp** - Cherna enjambre.

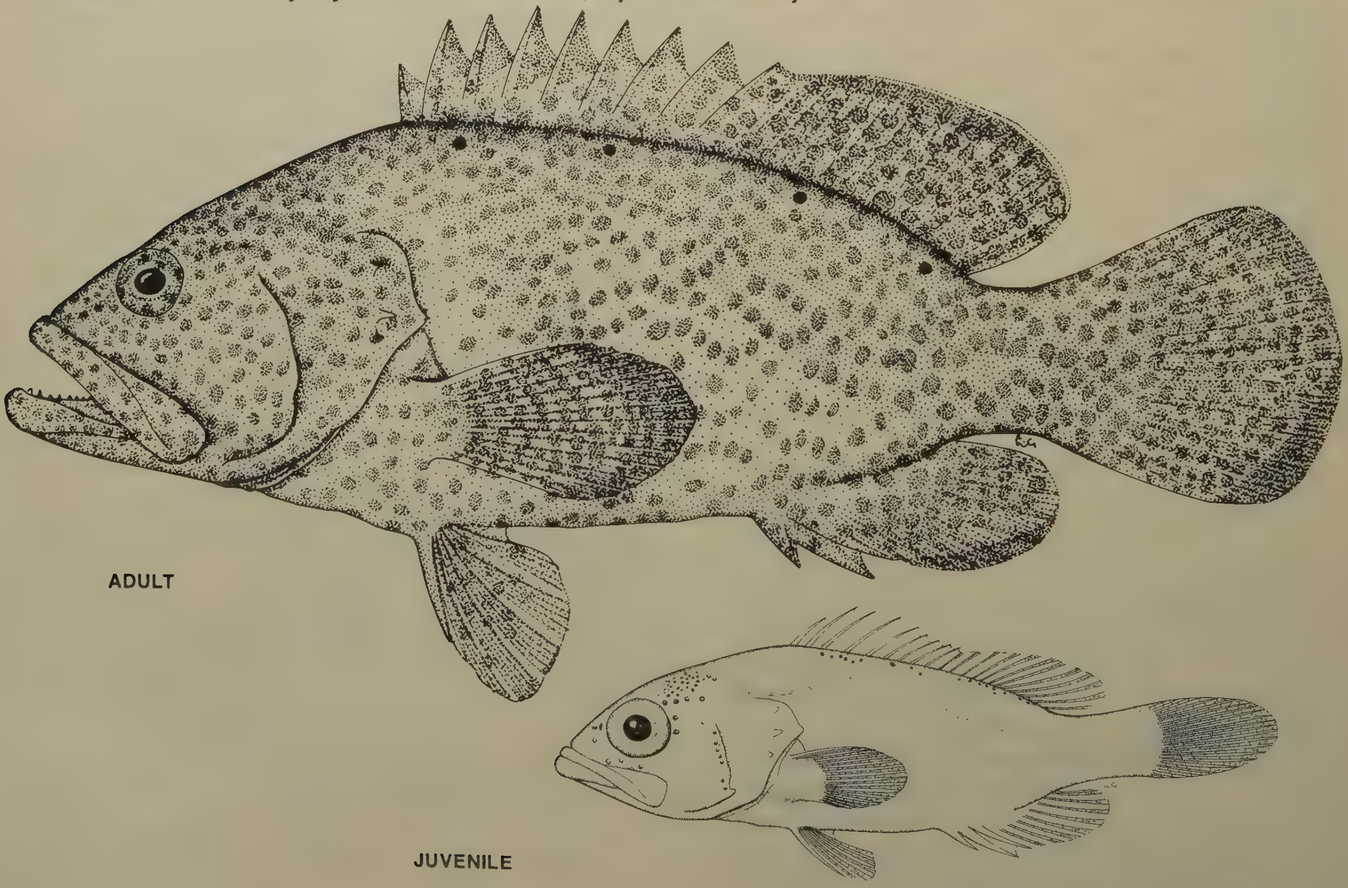


Fig. 77 *Cephalopholis cruentata*
(adult 200 mm standard length, juvenile 21 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, body depth contained 2.5 to 2.9 times in standard length (for fish 13 to 26 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat to slight convex; preopercle rounded, finely serrate, with shallow notch above the angle; nostrils small, subequal; maxilla scaly, reaching past vertical at rear edge of eye. Gill rakers 18 to 25 (total). Dorsal fin with IX spines and 13 to 15 rays, the fourth or fifth spines longest and the membrane distinctly indented between all the spines; anal fin with III spines and 8 rays; pectoral-fin rays 16; caudal fin rounded. Lateral-body scales distinctly ctenoid; lateral-line scales 47 to 51; lateral-scale series 69 to 81. **Colour**: Head, body, and fins pale grey, brown, or olive green, covered with orange-brown or reddish spots; 4 distinct spots, which can change rapidly from black to white or back again, at base of dorsal fin; a middorsal white stripe sometimes present from tip of lower jaw to nape.

Geographical Distribution: Caribbean, Gulf of Mexico, North Carolina to southern Florida, Bahamas and Bermuda (Fig. 78).

Habitat and Biology: *C. cruentata* is found in *Thalassia* beds and on coral reefs from shore to depths of 170 m. In the eastern Gulf of Mexico, it occurs on the rocky reef ledge in depths greater than 27 m. Thompson and Munro (1978) observed that graysby were more abundant in heavily fished areas than in unexploited areas and presumed that it "benefits in some way from reduced competition or predation in the exploited areas, or that its catchability is significantly less than that of other groupers." A similar increase in the population of graysby in the absence of competitors and predators occurred after the 1971 red tide killed most of the groupers on shallow-water reefs off the west coast of Florida. Before 1971, *C. cruentata* was never observed or collected in less than 29 metres, but after the red tide of that year, it became common on reefs in 12 to 18 m until the summer of 1974 when it disappeared abruptly (Bullock and Smith, 1991).

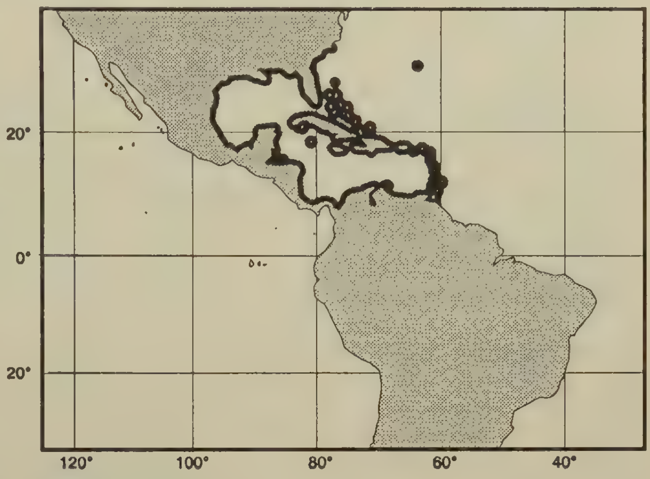


Fig. 78

Nagelkerken (1979) found that at the end of their first year, graysby were 8 cm long (standard length) and had formed 7 growth rings in their otoliths. Females mature at 16 cm (total length) and most change sex between 20 and 23 cm (ages 4 and 5), with sexual transition occurring immediately after spawning in August and September. Thompson and Munro (1978) estimated the number of eggs per spawning at 262 604 for a fish of 29 cm total length.

Graysby are small, secretive fish that usually stay near hiding places in the reef during the day. They are crepuscular predators, and adults feed mainly on fishes, with a preference for *Chromis multilineata*, where this species is abundant. Graysby have also been seen following moray eels in order to capture fishes disturbed from their hiding places by the foraging eels (Dubin, 1982). After sunset a greater proportion of crustacean prey is taken because of their increased nocturnal availability. Juveniles feed more on shrimps than on fishes.

Johnson and Keener (1984) illustrated the distinctive second dorsal- and pelvic-fin spines of the larvae. Both dorsal- and pelvic-fin spines have large, widely-spaced spinelets along their entire length, and those along the proximal part of the pelvic-fin spine are distinctly bifurcate.

Size: Maximum total length 32 cm.

Interest to Fisheries: Because of its small size, the graysby is of little commercial importance, but it undoubtedly represents a significant source of protein for local people. Caught with hook-and-line and in traps.

Local Names: CUBA: Enjambre; VENEZUELA: Cuna cabrilla.

Literature: Randall (1967); Smith (1971); Thompson and Munro (1978); Nagelkerken (1979); Bullock and Smith (1991).

Remarks: C.L. Smith (1971) reckoned that *C. cruentata* and *C. panamensis* were geminate species that have evolved as a result of the isolation of their parent population by the emergence of the Central American Isthmus. The colour patterns of these two species are quite distinct, but morphological differences are minor. In both species, the dorsal surface of the cranium has converging transverse ridges running from the lateral skull crests to the midline of the frontals. And Johnson and Keener (1984) noted that small juveniles of *C. panamensis* show bifurcate spinelets at the base of the pelvic-fin spines similar to the distinctive spination of *C. cruentata*.

Serranus nigriculus Valenciennes was assigned to the synonymy of ***Epinephelus adscensionis*** by C.L. Smith (1971), but the dorsal- and anal-fin ray counts of Valenciennes' syntypes (dorsal fin with IX spines and 14 rays; anal fin with III spines and 8 rays) would preclude such assignment. In the original description, Valenciennes (1828) says that the numbers of fin rays for ***E. nigriculus*** are the same as for ***Serranus catus*** (= *E. guttatus*), which he had just described; but this species has XI dorsal-fin spines. So it appears that Valenciennes had miscounted the dorsal-fin spines of his syntypes.

Cephalopholis cyanostigma (Valenciennes, 1828)

Fig. 79; Pl. IIC,D

SERRAN Cephal 19

Serranus cyanostigma Valenciennes in Cuv. and Val., 1828:359 (type locality: Java).

Synonyms: *Cephalopholis kendalli* Evermann and Seale, 1907a:76, fig. 11 (type locality: Bacon, Luzon, Philippines). *Cephalopholis xanthopterus* Allen and Starck, 1975:246, fig. 1 (type locality: Alite Reef, Solomon Islands).

FAO Names: **En** - Bluespotted hind; **Fr** - Vielle étoiles bleues; Sp - Cherna de pintas azules.

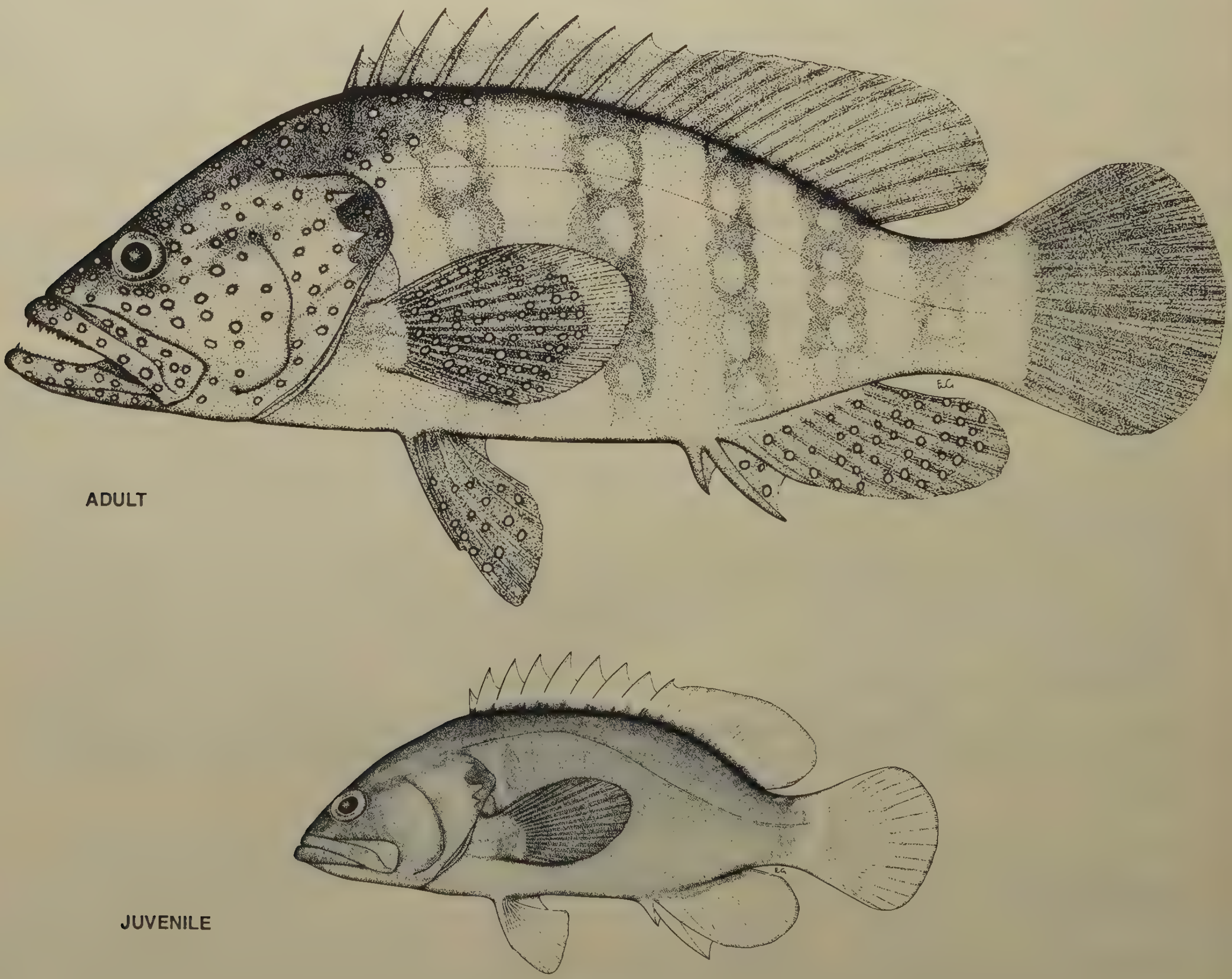


Fig. 79 ***Cephalopholis cyanostigma***
(adult 190 mm standard length, juvenile 93 mm standard length)

Diagnostic Features: Body somewhat compressed, the width contained 2.0 to 2.3 times in the depth; depth less than head length, contained 2.6 to 3.0 times in standard length (for fish 8 to 23 cm standard length). Head length 2.3 to 2.6 times in standard length; interorbital area flat to slightly convex, its width subequal to eye diameter and maxilla width; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth or with a few serrae; upper edge of operculum very convex, the rear edge almost vertical; maxilla scaly, reaching well past eye. Gill rakers 7 to 9 on upper limb, 14 to 18 on lower limb. Dorsal fin with IX spines and 15 to 17 rays, the fin membrane indented between the spines; anal fin with III spines and 8 rays; pectoral-fin rays 15 to 18; pectoral fins distinctly longer than pelvic fins, pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic fins usually not reaching anus, their length contained 1.8 to 2.1 times in head length; caudal fin well rounded. Body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 46 to 50; lateral-scale series 92 to 106. **Colour**: Adults brown to brownish red, with numerous small black-edged blue ocelli on head, body, and fins, those on head and chest larger and more distinctly black-edged than those on upper part of body, those on fins smaller (except basally on pectoral fins) and also distinctly black-edged (spots entirely dark in preservative, the ones on body faint); body often with dark chain-like bars; proximal half of pectoral fins coloured like body, the distal part orange-yellow with a blackish edge or white edge and black submarginal line; proximal two-thirds of pectoral fins with blue ocelli becoming smaller distally; median fins darker than body, the posterior margin bluish white with a submarginal blackish band. Juveniles with head, body, and pectoral fins dark brown, the other fins bright yellow; blue ocelli on head and front of body indistinct or absent.

Geographical Distribution: Tropical western Pacific, including Philippines, Thailand, Indonesia, Papua New Guinea, Palau, New Britain, Solomon Islands, and north coast of Australia from the Dampier Islands off Western Australia to the Capricorn Islands of the southern Great Barrier Reef (Fig. 80).

Habitat and Biology: *C. cyanostigma* occurs on coral reefs and seagrass or algal beds at depths of 1 to 50 m. Like most groupers, it feeds on crustaceans and fishes.

Size: Maximum total length 30 cm.

Interest to Fisheries: Probably of importance to artisanal fisheries. Caught with hook-and-line, spear, and in traps.

Local Names: AUSTRALIA: Bluespotted rock cod.

Literature: Marshall (1964); Grant (1975); Schroeder (1980, as *C. argus*); Coleman (1981); Randall and Heemstra (1991).

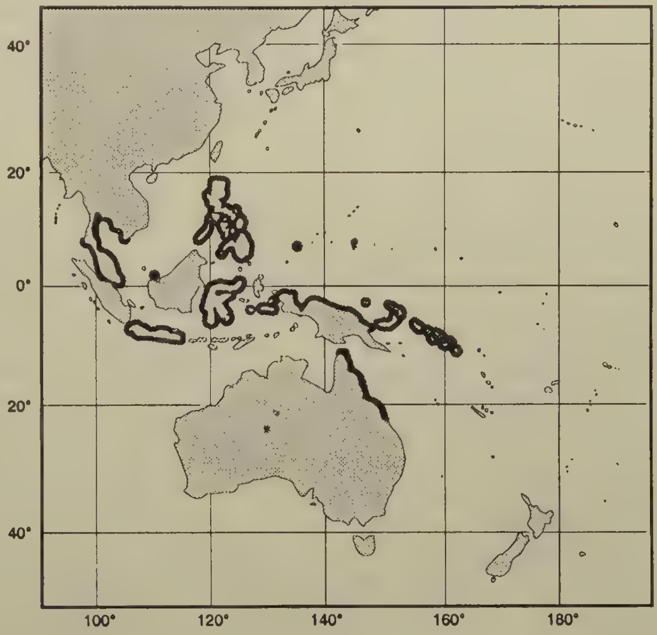


Fig. 80

Remarks: The report of *C. cyanostigma* from Réunion Island in the Indian Ocean (Postel et al., 1963) is based on a misidentification of *C. miniata*. And the record from the South China Sea (Tan et al., 1982) is illustrated with a photograph of *C. argus*. The colour pattern of juveniles is quite different from that of adults, and this led Allen and Starck (1975) to describe the juvenile as a new species. Randall found a transitional specimen (with yellow fins and blue spots) and initially thought it might be a new species. Sometime later, he was photographing what he thought was *C. xanthopterus*, and when the photographs were developed, the characteristic blue spots of *C. cyanostigma*, which were not seen on the fish underwater, were apparent on the photographs (revealed by the flash used for the photographs).

Cephalopholis formosa (Shaw and Nodder, 1812)

Fig. 81; Pl. IIE

SERRAN Cephal 12

Sciaena formosa Shaw and Nodder, 1812:23, pl. 1007 (type locality: Vizagapatam, Coromandel coast of India, after "Rahtee Bontoo" of Russell, 1803:22, pl. 129).

Synonyms: None.

FAO Names: **En** - Bluelined hind; **Fr** - Vielle lignes bleues; **Sp** - Cherna rayada.

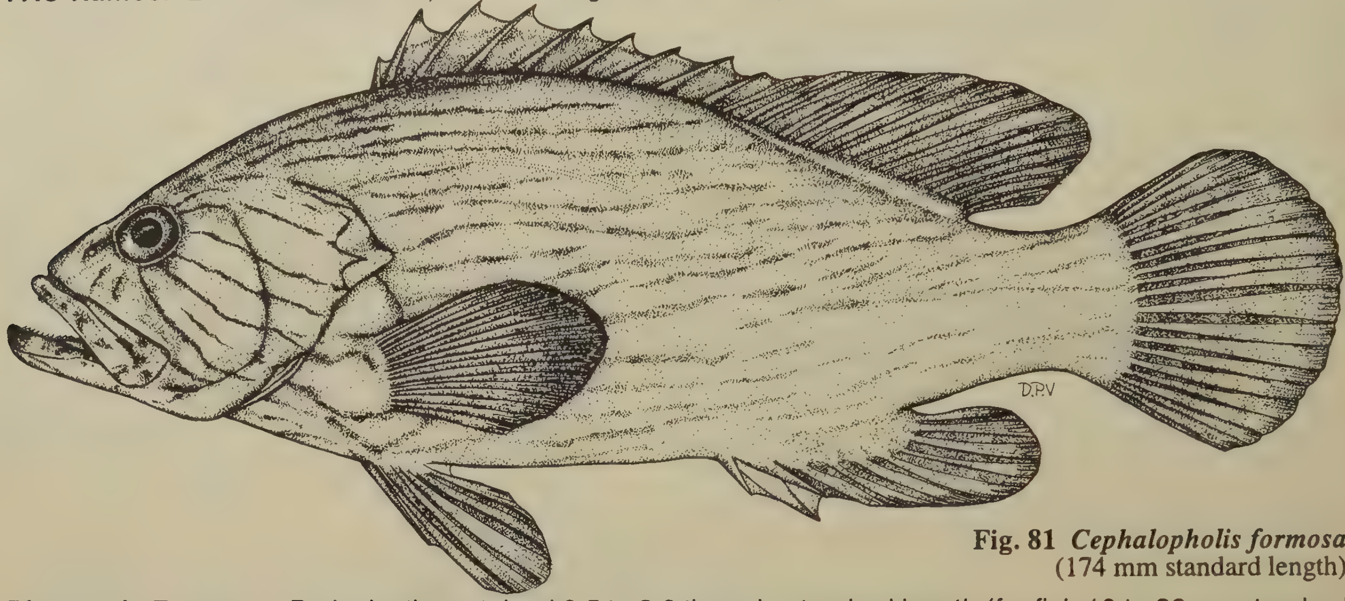


Fig. 81 *Cephalopholis formosa*
(174 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 2.9 times in standard length (for fish 10 to 26 cm standard length). Head length contained 2.4 to 2.6 times in standard length; preorbital depth 3.6 to 4.3% of standard length, more than half maxilla width; interorbital area convex; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth; maxilla naked, reaching to or just past vertical at rear edge of eye. Gill rakers 8 to 10 on upper limb, 14 to 18 on lower limb. Dorsal fin with IX spines and 15 to 17 rays, the membranes indented between the spines; anal fin with III spines and 8 (rarely 7) rays, the second spine 12.0 to 14.6% of standard length, not reaching past tip of third spine; pectoral-fin rays 16 to 18; pectoral fins usually longer than pelvic fins, pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic fins reaching about to anus, their length contained 1.6 to 2.0 times in head length; caudal fin well rounded. Body scales ctenoid, without auxiliary scales; lateral-line scales 47 to 51; lateral-scale series 91 to 109. **Colour**: Dark brown to yellowish brown, with slightly irregular dark blue lines on head, body, and fins (those on body and fins sometimes absent); snout, lips, and ventral part of head and chest with small dark blue spots (blue markings become black in preservative, and may be lost on some specimens, especially older museum material).

Geographical Distribution: Like *C. boenak*, the distribution of *C. formosa* is primarily continental, and it seems to avoid atolls or oceanic islands. Reports of "*Epinephelus formosus*" from Madagascar (Sauvage, 1875), or Réunion and Mauritius (Bleeker, 1875) are probably based on misidentifications of *Cephalopholis polleni*. It is known from Sri Lanka and the Lakshadweep Islands; but there are no other reports from islands in the western Indian Ocean. It occurs from western India to Thailand, Indonesia, Philippines, China, Taiwan, Japan (Honshu), and northern Australia (Fig. 82).

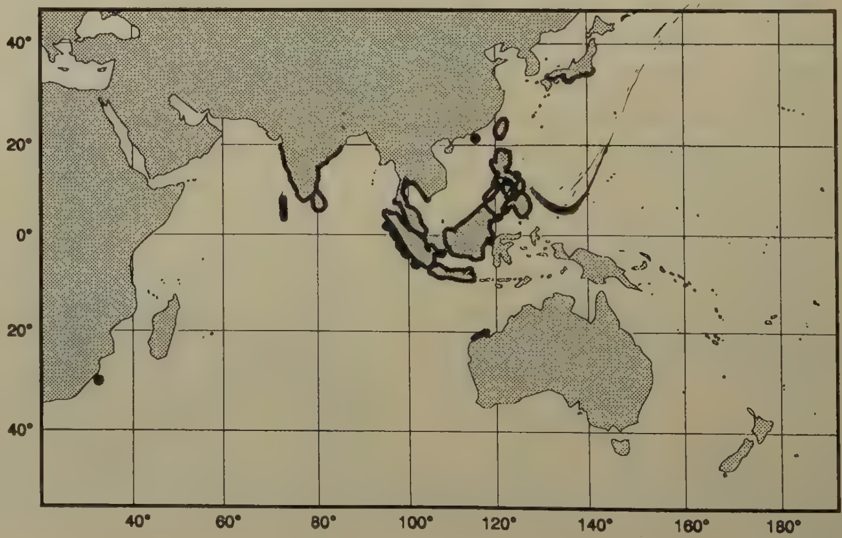


Fig. 82

Habitat and Biology: Also like *C. boenak*, the preferred habitat of *C. formosa* is shallow dead or silty reefs. And this may account for the primarily continental distributions of these two species.

Size: Maximum total length 34 cm.

Interest to Fisheries: *C. formosa* is too small to be of commercial importance as a food fish. Caught with hook-and-line, traps, and in trawls.

Local Names: INDIA: Bontoo (Telugu), Verri-cullawah (Tamil), Varianchamman (Lakshadweep islands); JAPAN: Aosujihata; SRI LANKA: Kangan kossa.

Literature: Heemstra and Randall (1984, 1986); Randall and Heemstra (1991).

Remarks: Following Boulenger (1895), most authors have confused *C. formosa* with *C. boenak* (e.g., Fowler and Bean, 1930; Munro, 1955; Katayama, 1988; Talwar and Kacker, 1984; Shen, 1984). These two species are distinguished in the account of *C. boenak* above.

Cephalopholis fulva (Linnaeus, 1758)

Fig. 83; Pls IIF, IIIA,B

SERRAN Cephal 5

Labrus fulvus Linnaeus, 1758:287 (type locality: America, after Catesby).

Synonyms: *Perca punctata* Linnaeus, 1758:291 (type locality: America, after Catesby). *Holocentrus auratus* Bloch, 1790:75 (type locality given erroneously as "East Indies"). *Bodianus guativere* Bloch and Schneider, 1801:336 (type locality: Cuba, after Parra). *Gymnocephalus ruber* Bloch and Schneider, 1801:346, pl. 67 (after Marcgrave, type locality: probably Brazil). *Serranus ouatalibi* Valenciennes in Cuv. and Val., 1828:381 (type locality: West Indies). *Serranus carauna* Valenciennes in Cuv. and Val., 1828:384 (after Marcgrave, type locality: probably Brazil).

FAO Names: En - Coney; **Fr** - Coné ouatalibi; **Sp** - Cherna cabrilla.

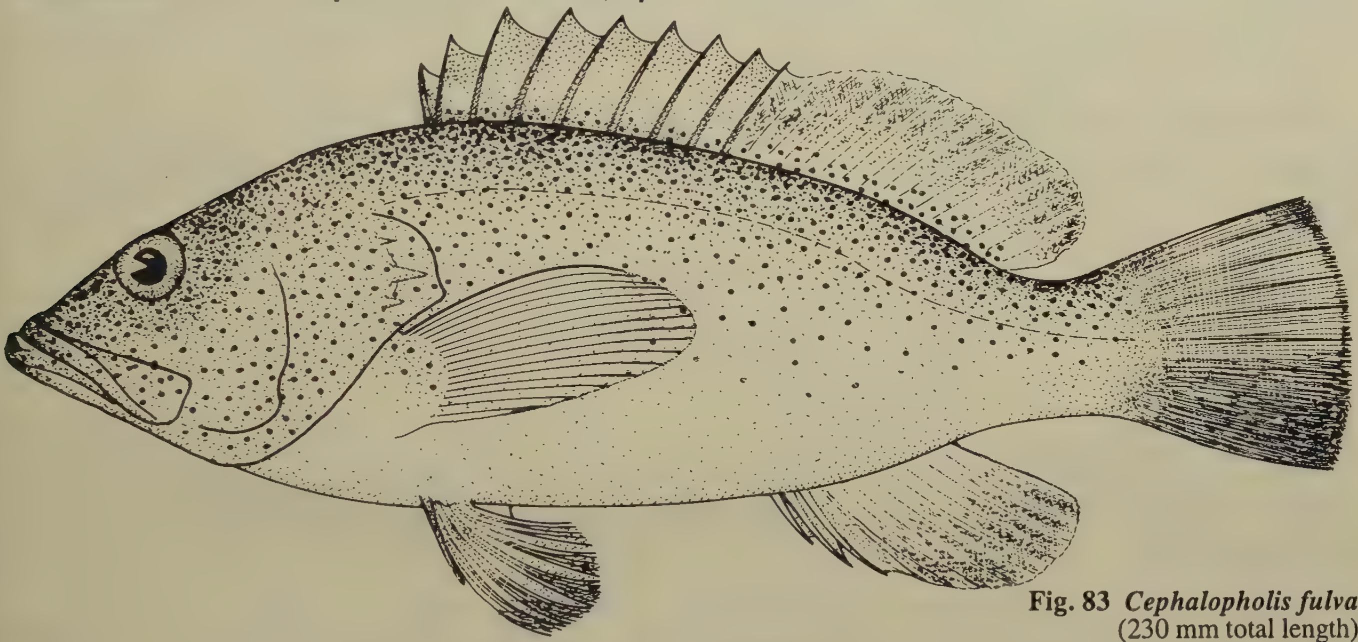


Fig. 83 *Cephalopholis fulva*
(230 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 2.9 times in standard length (for fish 10 to 25 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat; preopercle rounded, with a shallow notch above the angle; upper limb finely serrate, the serrae at angle moderately enlarged, the lower edge fleshy; subopercle and interopercle smooth; nostrils small, subequal; maxilla scaly, reaching to or beyond vertical at rear edge of eye. Gill rakers 7 to 9 on upper limb, 16 to 18 on lower limb, 23 to 27 total. Dorsal fin with IX spines and 14 to 16 rays, the membranes distinctly notched between the spines; anal fin with III spines and 9 rays; pectoral-fin rays 17 to 19; caudal fin convex posteriorly, but the corners are angular. Lateral-body scales ctenoid; lateral-line scales 46 to 54; lateral-scale series 90 to 97. **Colour:** There are three colour phases in this species: 1) red (deep water), 2) orange-brown or bicoloured with the upper part of the fish [above a line from tip of snout to posterior dorsal-fin rays] of normal colour and the lower part abruptly pale (shallow water) and 3) xanthic (a yellow morph that may be found in shallow or deep water). In the first two colour morphs, the head and body is covered with small dark-edged pale blue spots; in the xanthic form, these spots are fewer and confined to the head and front part of the body. In all three morphs, there are two small black spots on top of caudal peduncle and another two at tip of lower jaw. The bicoloured pattern of the shallow-water morph is apparently an excitement pattern, and it can be turned on or off in a few seconds. The night pattern is generally pale, with irregular vertical bars and a dark tuning-fork mark on interorbital region like that of *Epinephelus striatus*. The nuptial male has a horizontal dark brown band from lower end of pectoral-fin base to end of caudal fin, margin of soft dorsal fin black, dark stripe through eye, and a white spot on body near middle of dorsal-fin base.

Geographical Distribution: Tropical and subtropical western Atlantic from Bermuda and South Carolina to southern Brazil, including Atol das Rocas (Fig. 84).

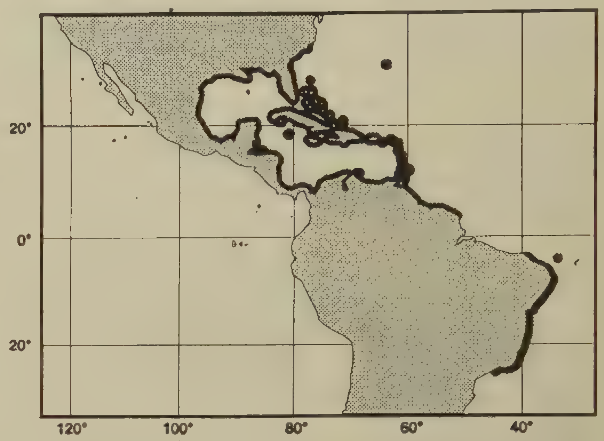


Fig. 84

Habitat and Biology: The coney prefers coral reefs and clear water. In the Gulf of Mexico it occurs on deep-water reefs (at a depth of at least 45 m) where the water is clear, but it is not seen on the more silty shallow-water reefs. At Bermuda and in the West Indies, the species is common in shallow water, but it usually hides in caves or under ledges during the day.

C. fulva is a protogynous species: females mature at 16 cm total length and transform to males at a length of about 20 cm. Males are territorial. Spawning occurs just before sunset over several days, and a male will spawn daily with each of the several females in his harem (P.L. Colin, personal communication). The spawning season begins at Bermuda in May and lasts until at least early August; the spawning season in the Bahamas is December-January, while in Jamaican waters the peak spawning period is from January to March. The eggs are typical grouper eggs, 0.95 mm in diameter, with a single oil globule. Fecundity estimates range from about 150 000 to 282 000 eggs per female. A few specimens that appear to be hybrids of ***C. fulva*** and ***Paranthias furcifer*** have been described by C.L. Smith (1966) and Thompson and Munro (1978). The coney feeds mainly on small fishes (46% by volume) and crustaceans. It occasionally follows morays and snake eels in order to feed on the normally inaccessible small fishes and invertebrates that are flushed from the interstices of the reef by the foraging eels.

Size: Maximum total length 33 cm (37 cm at Bermuda).

Interest to Fisheries: Although the small size of this species precludes it from being of commercial importance, it is abundant in the West Indies and often sold for food in the local markets. Caught with hook-and-line and in traps.

Local names: CUBA: Guativere (red phase), Canario (yellow phase); VENEZUELA: Corruncha.

Literature: Randall (1967); Smith (1971); Thompson and Munro (1978); Bullock and Smith (1991).

Cephalopholis hemistiktos (Rüppell, 1830)

Fig. 85; Pl. IIIC

SERRAN Cephal 13

Serranus hemistiktos Rüppell, 1830:109, pl. 27, fig. 3 (type locality: Massaua, Red Sea).

Synonyms: None.

FAO Names: **En** - Yellowfin hind; **Fr** - Vielle d'Arabie; **Sp** - Cherna arábiga.

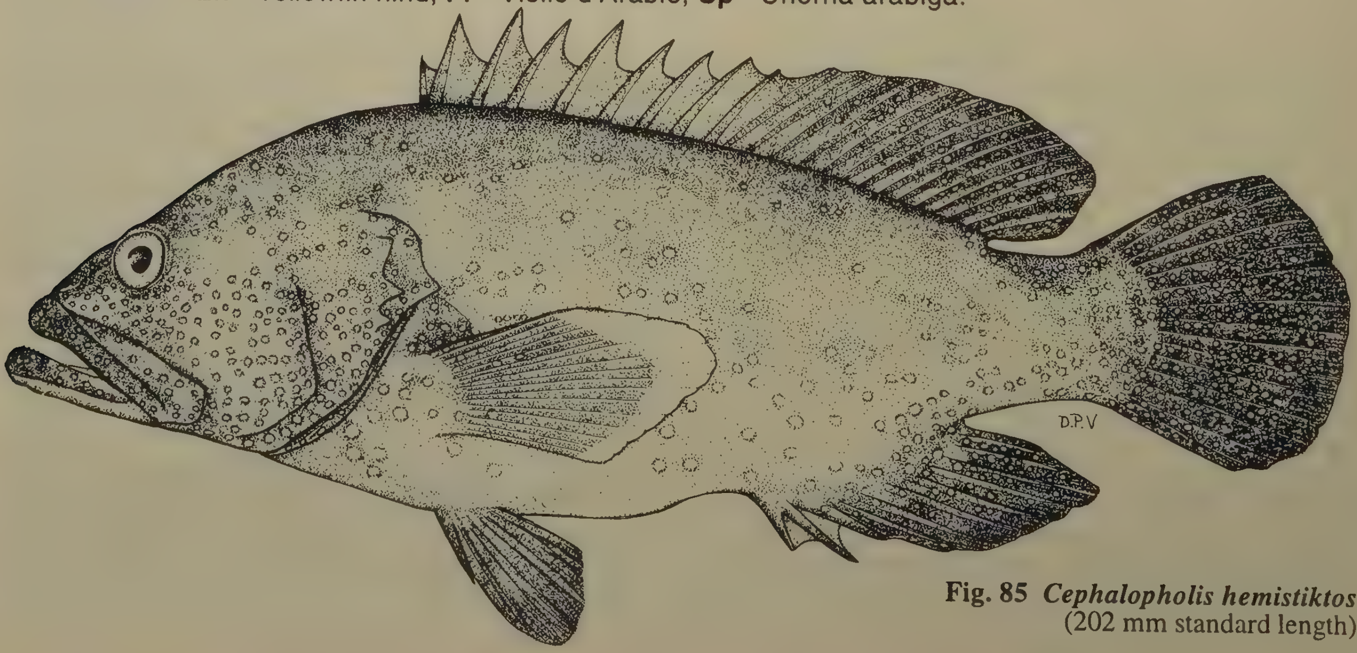


Fig. 85 ***Cephalopholis hemistiktos***
(202 mm standard length)

Diagnostic Features: Body depth less than head length, the depth contained 2.7 to 3.0 times in standard length (for fish 10 to 20 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat; preopercle rounded, finely serrate, the lower edge fleshy; upper edge of operculum distinctly convex; maxilla scaly, reaching to or somewhat beyond vertical at rear edge of eye. Gill rakers 6 to 8 on upper limb, 13 to 15 on lower limb. Dorsal fin with IX spines and 14 or rarely 15 rays, the membranes distinctly indented between the spines; anal fin with III spines and 8 to 10 rays, the posterior margin of the fin pointed in adults; pectoral-fin rays 16 to 18; pectoral fins pointed, distinctly longer than pelvic fins, pectoral-fin length contained 1.4 to 1.6 times in head length; pelvic fins nearly or just reaching anus, pelvic-fin length contained 1.7 to 2.0 times in head length; caudal fin well rounded. Body scales ctenoid; no auxiliary scales; lateral-line scales 47 to 52; lateral-scale series 95 to 121. **Colour**: The ground colour of specimens from shallow water is brownish, those from 15 to 20 m are brownish red, and fish from deep water are primarily reddish; dark-edged blue ocelli on head (more numerous ventrally) and on lower part of body; caudal fin and rear part of dorsal and anal fins darker than body, covered with small blue ocelli and their margins with a pale blue line; triangular membrane at tip of each dorsal-fin spine orange; pectoral fins mostly brown to reddish brown, with a few small blue ocelli at the base, the outer margin broadly and abruptly yellow; pelvic fins dark red to reddish brown, the rays darker than the membranes. Some fish with a large yellow or buff area below soft dorsal fin or alternating dark and pale bars on body (more distinct dorsally) with dark blotches on the head.

Geographic Distribution: Known with certainty only from the northern end of the Red Sea to the Persian Gulf and coast of Pakistan; records from elsewhere are apparently based on misidentifications of other species (Fig. 86).

Habitat and Biology: In the Red Sea, *C. hemistiktos* is more often found on patchy open reef areas rather than on well developed coral reefs; depths range from 4 to at least 55 m. It is a diurnal, ambush predator feeding throughout the day on fishes (64%, mostly pomacentrids) and crustaceans (36%). *C. hemistiktos* is a monogamous species, and each pair jointly defends a common territory of up to 62 m^2 (Shpigel and Fishelson, 1991).

Van Bertalanffy growth parameters were calculated by Matthews and Samuel (1987 [reported as *C. miniatus*]) from a sample of 36 specimens collected in the Persian Gulf: age range = 6 to 26 years; $L_\infty = 34.11$; $K = 0.1102$; $t_0 = -2.4160$; where L_∞ is theoretical maximum length, K is growth coefficient, and t_0 is theoretical age at zero length.

Size: Maximum total length 35 cm.

Interest to Fisheries: The small size of this species precludes it being of significant commercial importance. It probably is of some importance in local subsistence fisheries. Caught with handlines, traps, and spear.

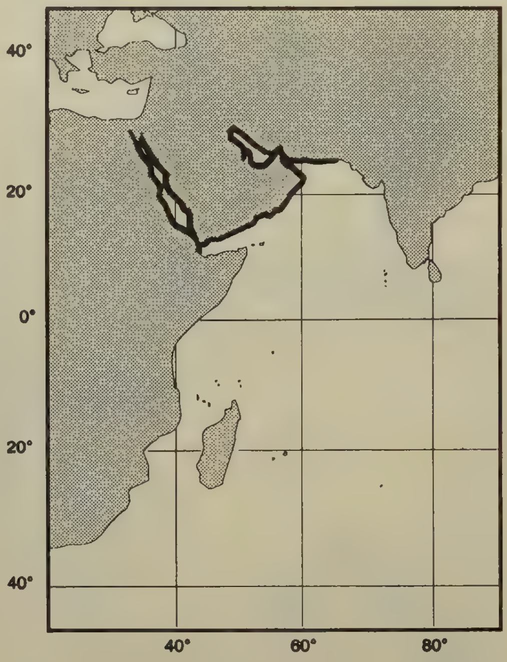


Fig. 86

Local Names: KUWAIT: Shnenu.

Literature: Randall and Ben-Tuvia (1983); Heemstra and Randall (1984, 1986); Kuronuma and Abe (1986); Shpigel and Fishelson (1989a and b).

Remarks: *C. hemistiktos* is the most common species of *Cephalopholis* in the Red Sea. The species that Kuronuma and Abe (1986) described and illustrated in colour as "*Cephalopholis miniatus*" from Kuwait is *C. hemistiktos*. *C. miniata* does not occur in the Persian Gulf, but these two species and *C. sexmaculata* are sympatric in the Red Sea.

Randall and Heemstra (1991) found slight differences in Red Sea specimens compared with those from the Gulf of Oman and Persian Gulf: pectoral-fin rays of Red Sea fishes modally 17 (n = 36), versus 18 (n = 18); lateral-scale series of Red Sea fish 95 to 104, versus 109 to 121; and the Red Sea *C. hemistiktos* are smaller (the largest of 75 specimens is only 167 mm standard length; versus 265 mm standard length for a fish from Iran).

C. hemistiktos is closely related to *C. miniata* and *C. sexmaculata*. These three differ slightly in colour pattern: in *C. hemistiktos*, there are no small blue spots on the dorsal part of the body, but in the other two species the entire body is covered with blue spots; the caudal fin and posterior parts of the dorsal and anal fins are distinctly darker than the rest of the body in *C. hemistiktos*, but these fins are not darker in the other species; and the outer margin of the pectoral fins is abruptly yellow in *C. hemistiktos*, but gradually orange-yellow distally in *C. miniata* and uniformly coloured (orange-red, like the body) in *C. sexmaculata*. Another minor difference is that in adults of *C. hemistiktos*, the anal fin is pointed posteriorly, and reaches past a vertical at the caudal-fin base, but in the other species it is evenly rounded and does not extend past the caudal-fin base. And *C. hemistiktos* usually has 14 dorsal-fin rays, while in the other species the usual count is 15.

Cephalopholis igarashiensis Katayama, 1957

Fig. 87; Pl. IIID

SERRAN Cephal 20

Cephalopholis igarashiensis Katayama, 1957:156, fig. 3 (type locality: Sumisu-tu, Izu Islands).

Synonyms: *Cephalopholis swanius* Tsai, 1960:188, fig. (type locality: Hua-lien, Taiwan).

FAO Names: **En** - Garish hind; **Fr** - Vielle voyant; **Sp** - Cherna chillona.

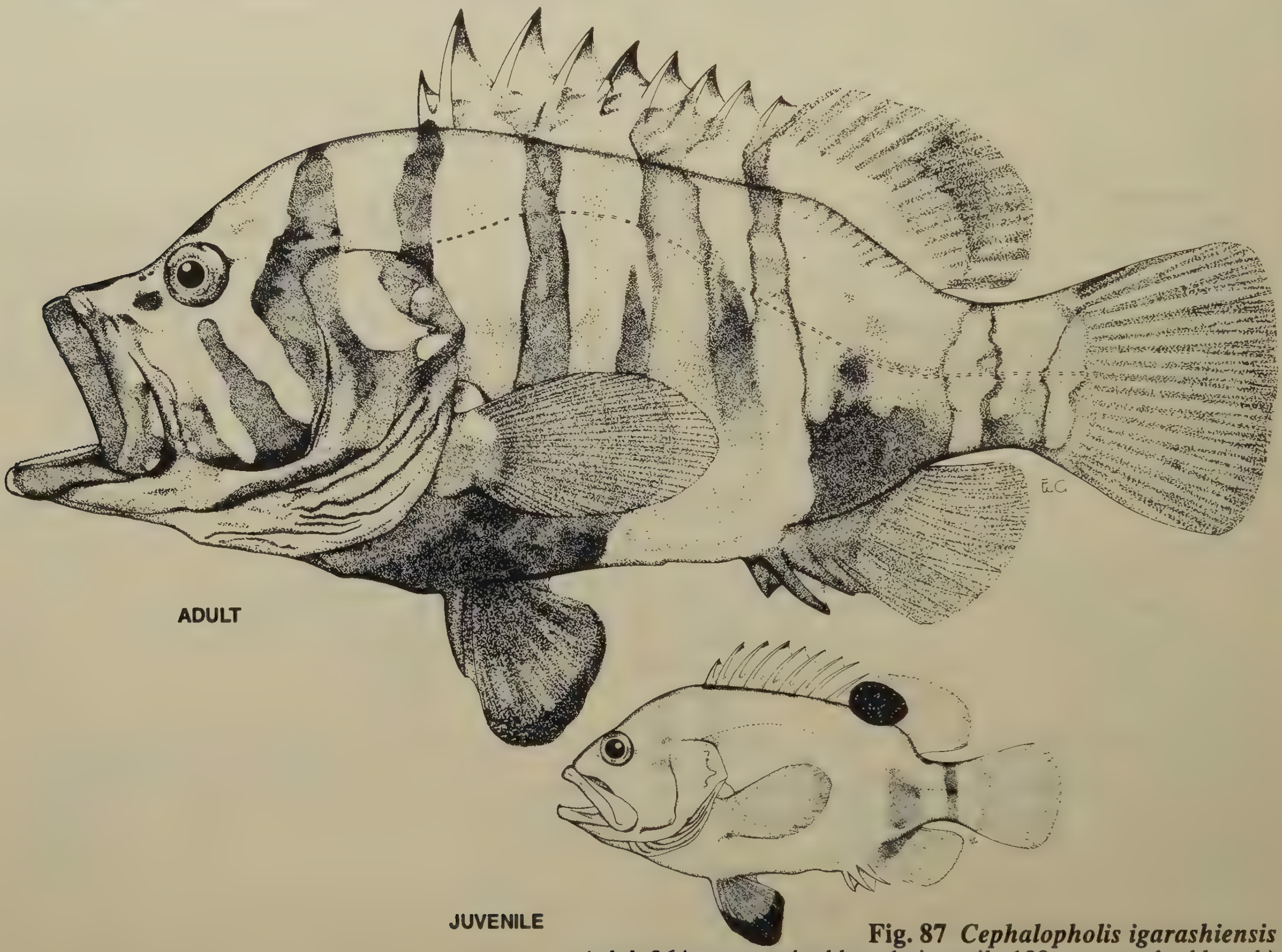


Fig. 87 ***Cephalopholis igarashiensis***
(adult 264 mm standard length, juvenile 139 mm standard length)

Diagnostic Features: Body depth greater than head length, the depth contained 2.0 to 2.4 times in standard length (for fish 13 to 29 cm standard length); body width contained 2.3 to 2.6 times in the depth; caudal-peduncle depth equal to or greater than its length. Head length contained 2.3 to 2.5 times in standard length; dorsal head profile straight or slightly concave to above eye, the nape markedly convex; interorbital area flat; preopercle rounded, finely serrate, the ventral serrae slightly enlarged, the lower edge irregular but hidden by skin; subopercle and interopercle finely serrate; upper edge of operculum distinctly convex; maxilla naked, reaching vertical at rear edge of eye; a prominent knob on the ventral rear corner. Gill rakers 8 or 9 on upper limb, 16 or 17 on lower limb. Dorsal fin with IX spines and 14 rays, the membranes distinctly indented between the spines; anal fin with III spines and 9 rays; pectoral-fin length contained 1.6 to 1.8 times in head length; pectoral-fin rays 18 or 19; pelvic fins reach to or beyond anus, their length contained 1.7 to 2.0 times in head length; caudal fin rounded. Lateral line noticeably arched over pectoral fin. Body scales ctenoid, without auxiliaries; lateral-line scales 60 to 65; lateral-scale series 101 to 117. **Colour**: Head, body, and fins reddish orange; 7 lemon yellow bars on dorsal part of body, extending onto dorsal fin; 3 broad yellow bands radiating from eye; fins red, except for extension of yellow bars from body into dorsal fin and membranes at tips of dorsal-fin spines, which are orange. Juveniles more yellowish, with a large black spot in dorsal fin, pelvic fins and tips of interspinous dorsal-fin membranes blackish; tips of pelvic fins blackish in large juveniles or small adults.

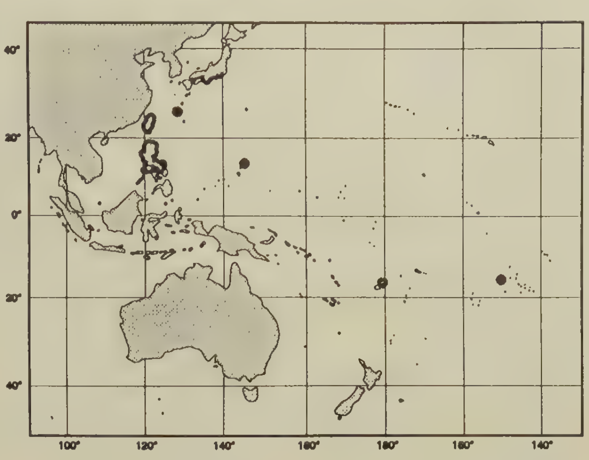


Fig. 88

Geographic Distribution: Tropical western Pacific: southern Japan, Taiwan, Guam, Philippines, South China Sea, Samoa, and Tahiti (Fig. 88).

Habitat and Biology: *C. igarashiensis* is a rare, deep-water grouper; Schroeder (1980) gives the depth range as "down to 80 m," and the specimen from Tahiti was taken in 250 m. Like most groupers, it is said to feed on fishes and crustaceans (Schroeder, 1980).

Size: Maximum total length about 43 cm.

Interest to Fisheries: This species seems too rare to be of commercial importance.

Local Names: JAPAN: Shima-hata; PHILIPPINES: Kubing (Visayan), Bulang (Cuyonin).

Literature: Randall and Heemstra (1991).

Remarks: This distinctive species differs from all other species of *Cephalopholis* in its greater body depth and unique colour pattern. The species name is an adjectival patronym in honour of Mr Igarashi, who collected the holotype.

Cephalopholis leopardus (Lacepède, 1801)

Fig. 89; Pl. IIIE

SERRAN Cephal 14

Labrus leopardus Lacepède, 1801:450, 517, pl. 30, fig. 1 (type locality: Indian Ocean).

Synonyms: *Serranus spilurus* Valenciennes in Cuv. and Val., 1833:433 (type locality: Mauritius). *Serranus homfrayi* Day, 1870:678 (type locality: Port Blair, Andaman Islands). *Epinephelus urodelops* Schultz, 1943:105, fig. 8 (type locality: Canton Island, Phoenix Islands).

FAO Names: **En** - Leopard hind; **Fr** - Vielle léopard; **Sp** - Cherna leopardo.

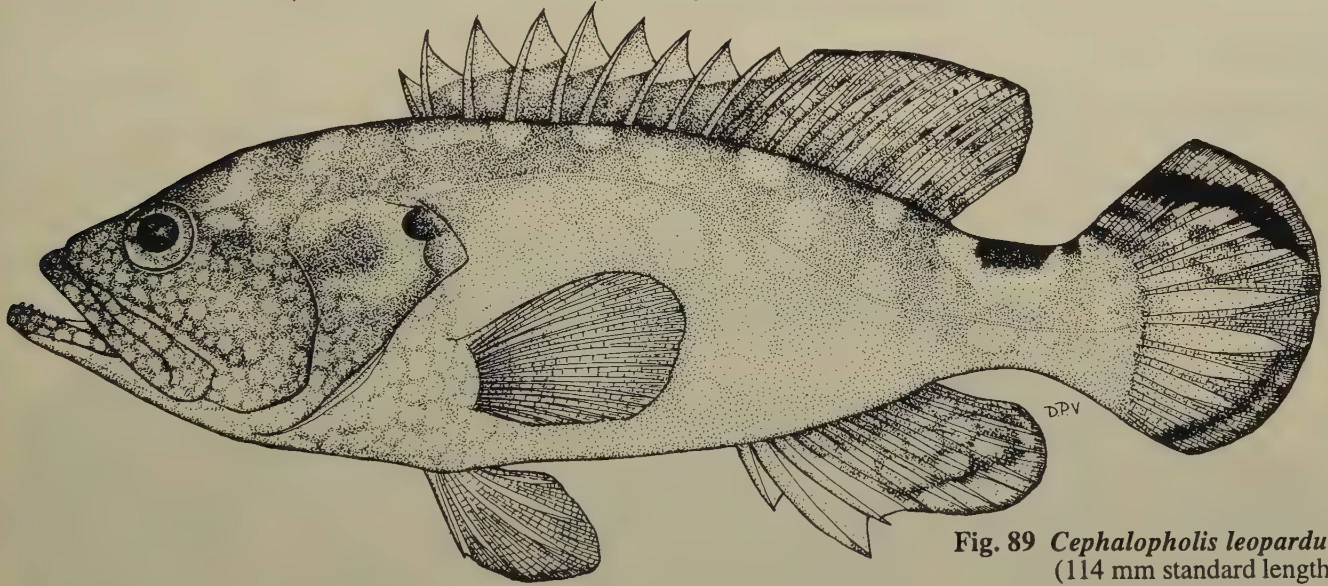


Fig. 89 *Cephalopholis leopardus* (114 mm standard length)

Diagnostic Features: Body depth less than head length, contained 2.5 to 2.8 times in standard length (for fish 5 to 14 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area flat; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth; upper edge of operculum distinctly convex; maxilla extends past eye. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb. Dorsal fin with IX spines and 13 to 15 rays; anal fin with III spines and 9 or 10 rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.4 to 1.6 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.3 times in head length; caudal fin well rounded. Body scales ctenoid, no auxiliary scales; lateral-line scales 47 to 50; lateral-scale series 79 to 88. **Colour**: Head and body mottled reddish brown, paler ventrally with numerous red-orange or pinkish red spots; dark brown saddle on caudal peduncle and a similar, but much smaller spot just behind; dark brown or reddish submarginal streak on upper part of caudal fin and a fainter reddish streak on lower part of fin; dark brown spot at rear end of operculum; pectoral fins yellowish on some fish.

Geographic Distribution: Western Indian Ocean to the central Pacific, including east African coast from Kenya to about 15°S, most islands of the Indian Ocean, Viet Nam, Indonesia, Philippines, Taiwan, Okinawa, Papua New Guinea, northern Australia, and most islands of the west-central Pacific. *C. leopardus* is absent from the Red Sea and Persian Gulf (Fig. 90).

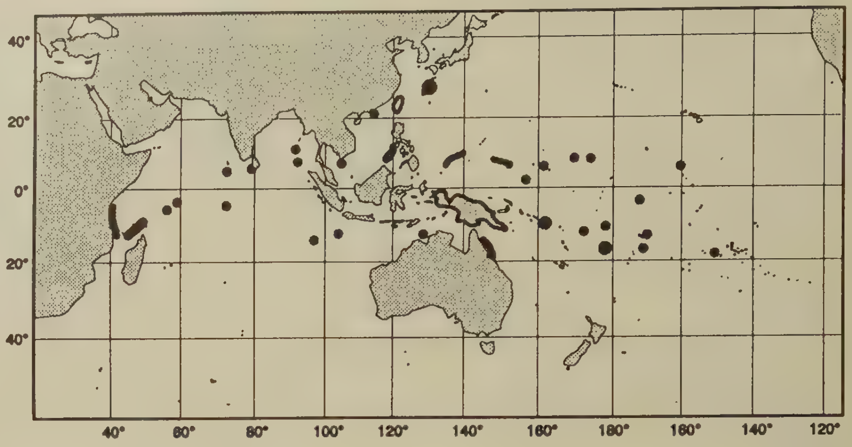


Fig. 90

Habitat and Biology: Well-developed coral reefs in depths of 3 to 38 m. Morgans (1982) reported crustacean remains in the two specimens containing food that he examined. Like most small groupers, this is a secretive species, which is usually hiding in caves and crevices in the reef.

Size: Maximum total length 20 cm (larger sizes reported in the literature are unsubstantiated).

Interest to Fisheries: None.

Local Names: AUSTRALIA: Red-spotted rockcod; JAPAN: Minami-isohata; PALAU: Elewik; PHILIPPINES: Pugapo (Visayan).

Literature: Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Remarks: This is one of the smallest species of groupers known.

Cephalopholis microprion (Bleeker, 1852) Fig. 91; Pl. IIIF SERRAN Cephal 21

Serranus microprion Bleeker, 1852b:552 (type localities: Ambon and Batavia).

Synonyms: None.

FAO Names: **En** - Freckled hind; **Fr** - Vielle tache de rousseur; **Sp** - Cherna pecosa.

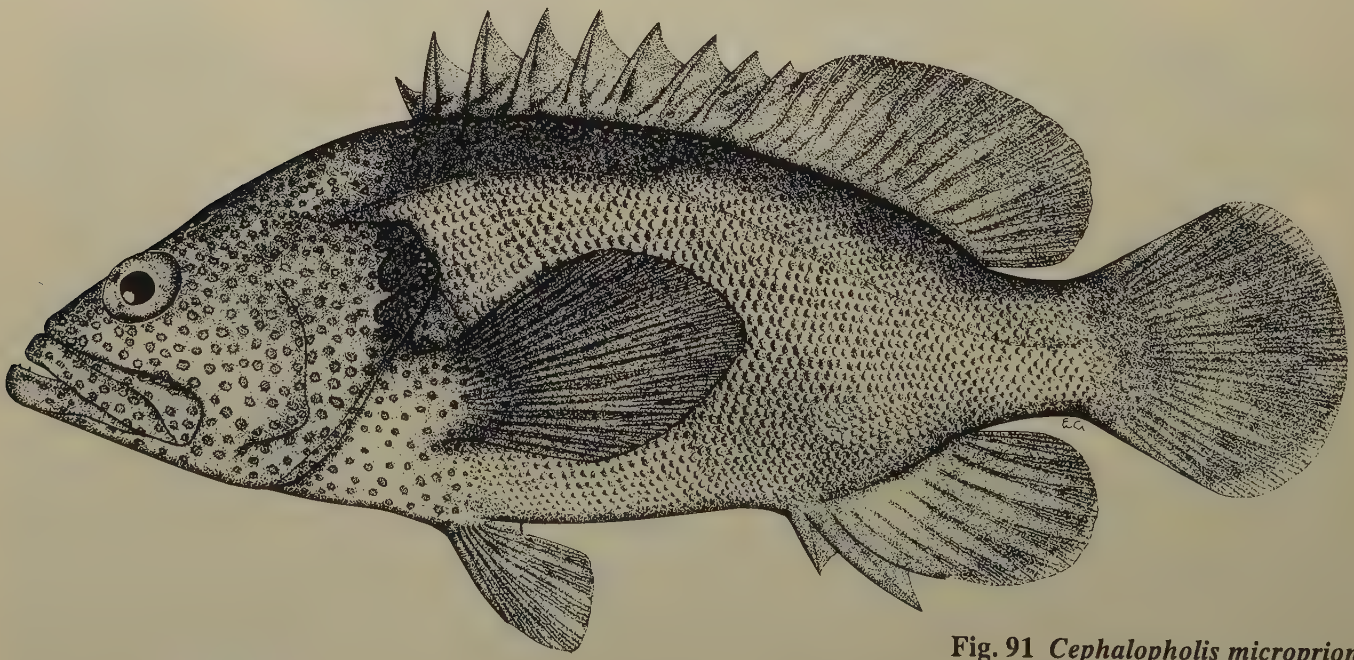


Fig. 91 *Cephalopholis microprion* (124 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 2.8 times in standard length (for fish 9 to 19 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat or slightly concave; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth or finely serrate; upper edge of operculum very convex; maxilla naked, extending past eye. Gill rakers 7 to 9 on upper limb, 14 to 17 on lower limb. Dorsal fin with IX spines and 14 to 16 rays; anal fin with III spines and 8 rays; pectoral-fin rays 14 to 16; pectoral fins usually reaching past vertical at anus, their length contained 1.4 to 1.6 times in head length; pelvic-fin length contained 1.9 to 2.1 times in head length; caudal fin well rounded. Body scales ctenoid, without auxiliary scales; lateral-line scales 45 to 51; lateral-scale series 84 to 98. **Colour**: Dark brown, the proximal part of each scale darker than the posterior part; some fish with indistinct dark bars on body; head (including jaws) and anterior part of body with numerous small dark-edged blue ocelli; some fish also have blue ocelli on the fins; soft dorsal, anal, and caudal fins usually with a greyish blue margin (narrow or absent at tips of central caudal rays).

Geographic Distribution: Tropical eastern Indian Ocean and western Pacific: Andaman Sea, Gulf of Thailand, Indonesia, Philippines, Papua New Guinea, Great Barrier Reef, Solomon Islands, and New Caledonia (Fig. 92).

Habitat and Biology: *C. microprion* is a shallow-water species usually found on silty reefs.

Size: Maximum total length about 24 cm.

Interest to Fisheries: Because of its small size, this species is of minor importance to fisheries. Caught with hook-and-line and probably in traps.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: Following Boulenger's (1895) influential work *C. microprion* was usually considered a synonym of *C. pachycentron* (*C. boenak*). Randall (1987) recognized *C. microprion* as a valid species, and distinguished it from *C. boenak*.

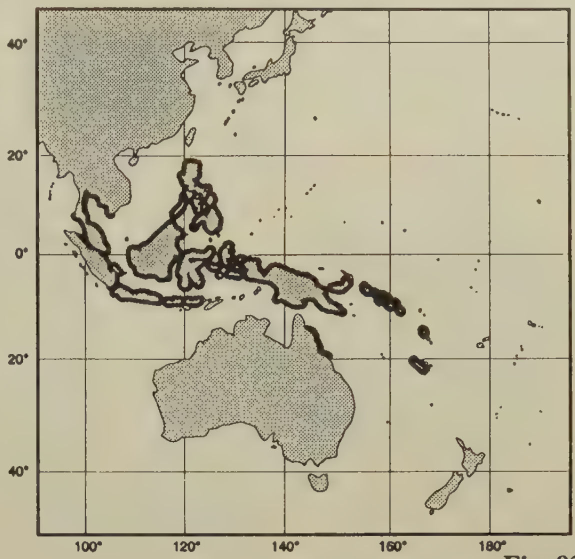


Fig. 93

Cephalopholis miniata (Forsskål, 1775) Fig. 93; Pl. IVA,B SERRAN Cephal 1

Perca miniata Forsskål, 1775:41 (type localities: Jeddah and Hudaydah, Red Sea).

Synonyms: *Pomacentrus burdi* Lacepède, 1802:511 (on *Perca miniata* Forsskål). *Serranus cyanostigmatoides* Bleeker, 1849:31 (type locality: Jakarta, Indonesia). ?*Serranus perguttatus* De Vis, 1884b:445 (type locality: Vanuatu). *Cephalopholis maculatus* Seale and Bean, 1907:235, fig. 5 (type locality: Zamboanga, Mindanao, Philippines). *Cephalopholis formosanus* Tanaka, 1911:24, pl. 7, fig. 22 (type locality: Taihoku, Taiwan). *Cephalopholis boninius* Jordan and Thompson, 1914:248, pl. 29, fig. 7 (type locality: Bonin Islands).

FAO Names: **En** - Coral hind (formerly: Vermilion seabass); **Fr** - Vielle de corail (formerly: Vielle étoilée); **Sp** - Cherna estrellada.

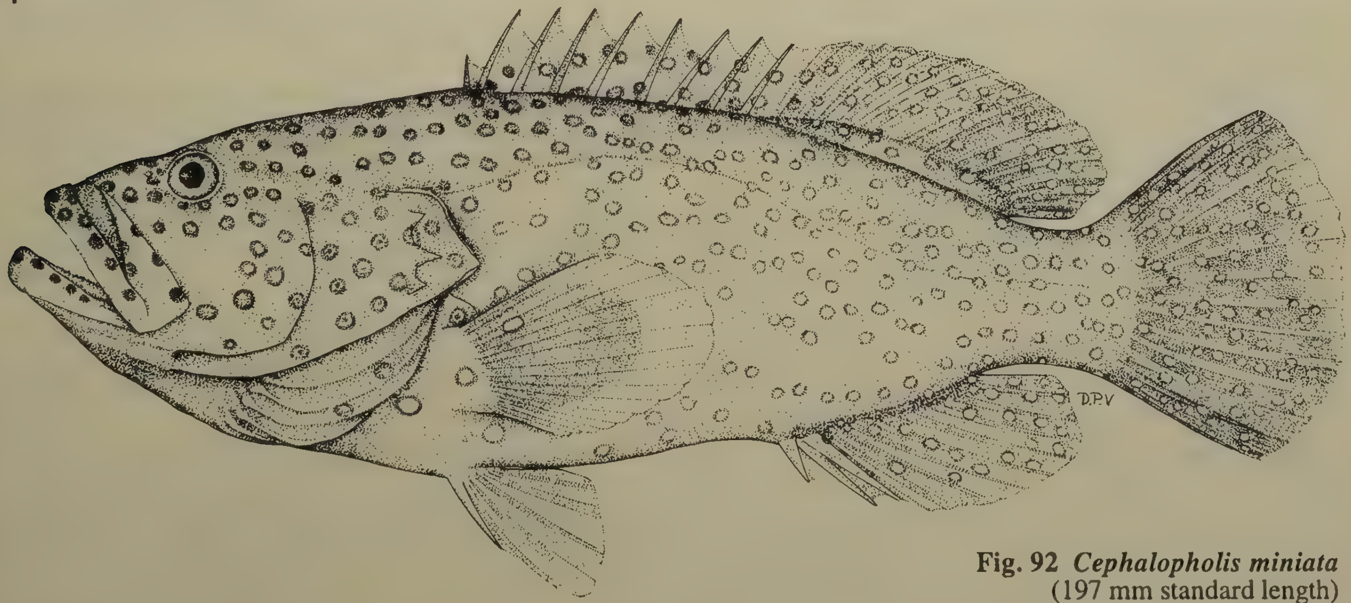


Fig. 92 *Cephalopholis miniata*
(197 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 3.0 times in standard length (for fish 10 to 30 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat to slightly convex; preopercle rounded, finely serrate, the lower edge fleshy; upper edge of operculum very convex; maxilla scaly, reaching to or beyond vertical at rear edge of eye. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with IX spines and 14 to 16 rays, the membranes distinctly indented between the spines; anal fin with III spines and 9 (rarely 8) rays, the fin margin rounded in adults; pectoral-fin rays 17 or 18, pectoral-fin length contained 1.4 to 1.75 times in head length; pelvic fins usually not reaching anus, their length contained 1.9 to 2.3 times in head length; caudal fin well rounded. Midlateral-body scales ctenoid; no auxiliary scales; lateral-line scales 47 to 56; lateral-scale series 94 to 114. **Colour**: Orange-red to reddish brown, covered with small (usually dark-edged) pale blue-grey spots; pectoral fins orange-yellow distally; soft dorsal, caudal, and anal fins often with a narrow blue margin and blackish submarginal line; pelvic fins orange-red, the distal edge dark bluish grey. Juveniles more yellowish, with faint pale blue spots, fewer than in adults.

Geographic Distribution: Tropical Indo-Pacific and Red Sea (but not the Persian Gulf or French Polynesia), from the African coast (south to Durban, South Africa) to the Line Islands in the central Pacific, including most islands in the Indian and west-central Pacific oceans, southern Japan, Taiwan, Philippines, Indonesia, northern Australia, Papua New Guinea, New Caledonia, and the islands of Micronesia (Fig. 94). One specimen, presumably an immigrant from the Red Sea, was reported from the Gulf of Genoa in the Mediterranean Sea (Torchio in Hureau and Monod, 1978:359).

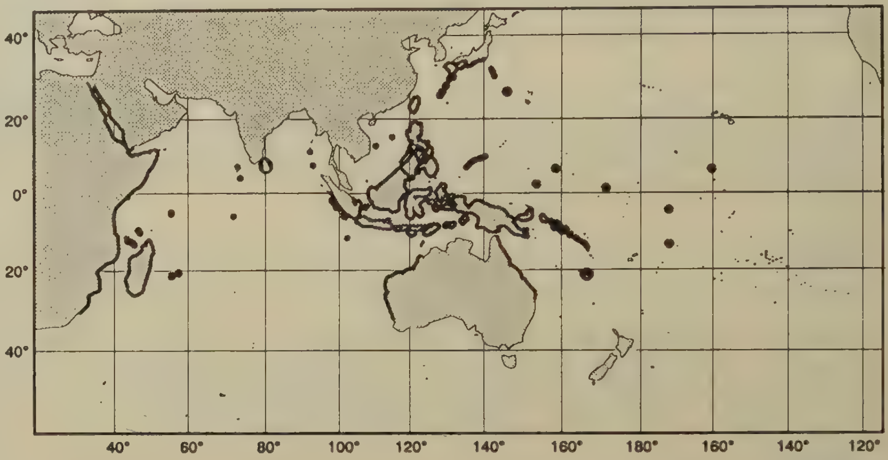


Fig. 94

Habitat and Biology: *C. miniata* is usually found on well-developed exposed coral reefs in clear water at depths of 2 to 150 m. Shpigel and Fishelson (1989) found that it feeds mainly during the early morning (07.00 to 09.00 h) and midafternoon (14.00 to 16.00 h). Most of the prey (86%) were fishes that school just above the reef (predominantly *Pseudanthias squamipinnis*), and most of these were caught by a quick rush ("ambush attack") from the bottom. The remaining 14% of the food comprised crustaceans. *C. miniata* forms haremic groups comprising a dominant male and 2 to 12 females. These groups occupy territories of up to 475 m^2, subdivided into secondary territories, which are defended by a single female (Shpigel and Fishelson, 1991). Morgans (1982) reported sexual maturity (females?) at 25 cm standard length, and fishes as the only food item in the 6 specimens with stomach contents that he examined.

Size: Maximum total length about 40 cm.

Interest to Fisheries: Although rather small, *C. miniata* is a common species that is of considerable economic importance to local fisheries. It is caught with hook-and-line, spear, and in traps.

Local Names: AUSTRALIA: Blue-spotted rockcod, Coral cod, Coral trout; JAPAN: Yukatahata; MADAGASCAR: Alovo; PALAU: Rumekei; PHILIPPINES: Lapu-lapung señora (Tagalog); SEYCHELLES: Vermillion seabass, Coral rockcod, Vielle anana, Vielle rouge; SINGAPORE: Kerapu bar.

Literature: Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Remarks: *C. miniata* is compared with *C. hemistiktos* under that species account.

Cephalopholis nigri (Günther, 1859)

Fig. 95

SERRAN Cephal 6

Serranus nigri Günther, 1859:112 (type locality: mouth of the Niger River).

Synonyms: *Serranus lineo-ocellatus* Guichenot in Duméril, 1861:244 (type locality: Gabon, Gorée). *Petrometopon nigri*.

FAO Names: **En** - Niger hind; **Fr** - Mérou du Niger; **Sp** - Cherna del Niger.

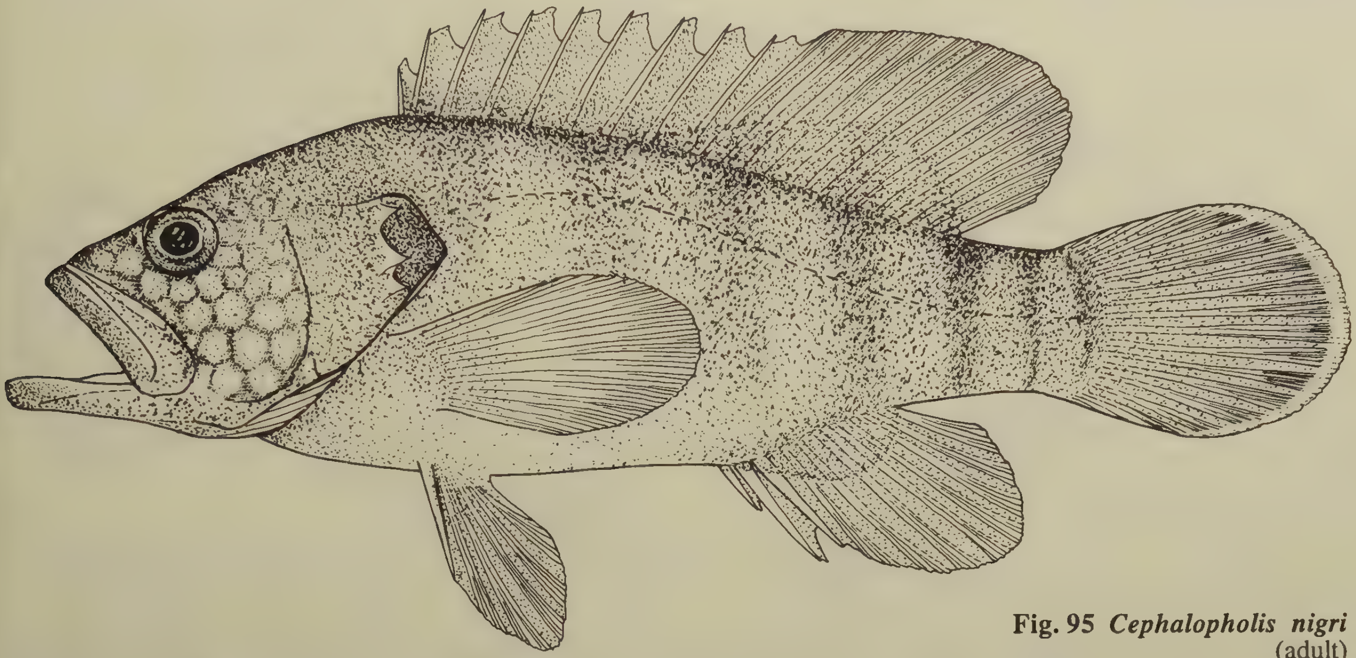


Fig. 95 *Cephalopholis nigri* (adult)

Diagnostic Features: Body depth distinctly less than head length, the depth contained 2.8 to 3.0 times in standard length (for fish 11 to 15 cm standard length). Head length contained 2.5 to 2.6 times in standard length; eye diameter greater than interorbital width, eye diameter contained 4.6 to 5.5 times in head length; interorbital area flat; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth; upper edge of operculum convex; maxilla scaly, reaching well past eye. Gill rakers 8 to 10 on upper limb, 14 to 17 on lower limb; 5 or 6 rudiments on each limb. Dorsal fin with IX spines and 14 or 15 rays, the membranes distinctly indented between the spines; anal fin with III spines and 8 rays; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.4 to 1.7 times in head length; pelvic fins reach anus, their length contained 1.6 to 1.9 times in head length; caudal fin rounded. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 45 to 50; lateral-scale series 73 to 80. **Colour**: Dark brownish, with 3 or 4 indistinct dark bars on body (extending onto dorsal fin) and 2 more on caudal peduncle; belly reddish; sides of head with close-set reddish spots forming a reticulated pattern of dark lines; pelvic and anal fins dusky, with small pale (silvery?) spots; tips of interspinous dorsal-fin membranes black. A 13 cm (total length) juvenile from the Canary Islands has red spots all over the head and body.

Geographical Distribution: Tropical eastern Atlantic from Senegal to Lobito, Angola, also Canary Islands (Tenerife) (Fig. 96).

Habitat and Biology: Mud, sand, and rock bottoms from shore to depths of probably around 50 m. Occasionally found in estuaries.

Size: Maximum total length 30 cm.

Interest to Fisheries: Too small to be of commercial importance.

Local Names: SENEGAL: Kelle, Lajoojh, Khonke.

Literature: Fowler (1936); Gras (1960); Bianchi (1986); Bellemans et al. (1988); Schneider (1990); Heemstra (1991).

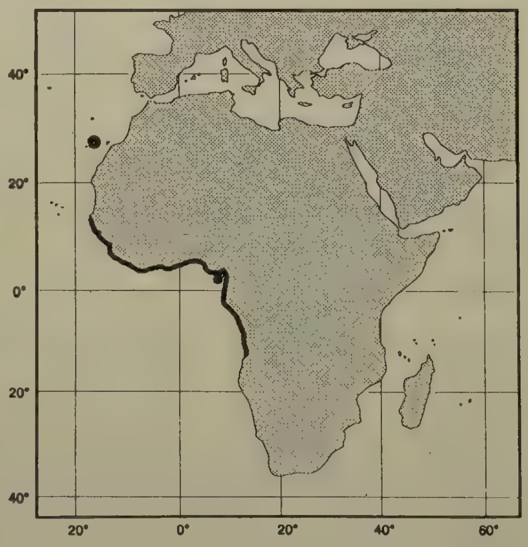


Fig. 96

Cephalopholis oligosticta Randall and Ben-Tuvia, 1983

Fig. 97; Pl. IVC

SERRAN Cephal 16

Cephalopholis oligosticta Randall and Ben-Tuvia, 1983:386, pl. 1, fig. D (type locality: Red Sea, Sudan, Port Sudan).

Synonyms: None.

FAO Names: **En** - Vermilion hind (formerly: Roughcheek hind); **Fr** - Vielle de la Mer Rouge; **Sp** - Cherna del Mar Rojo.

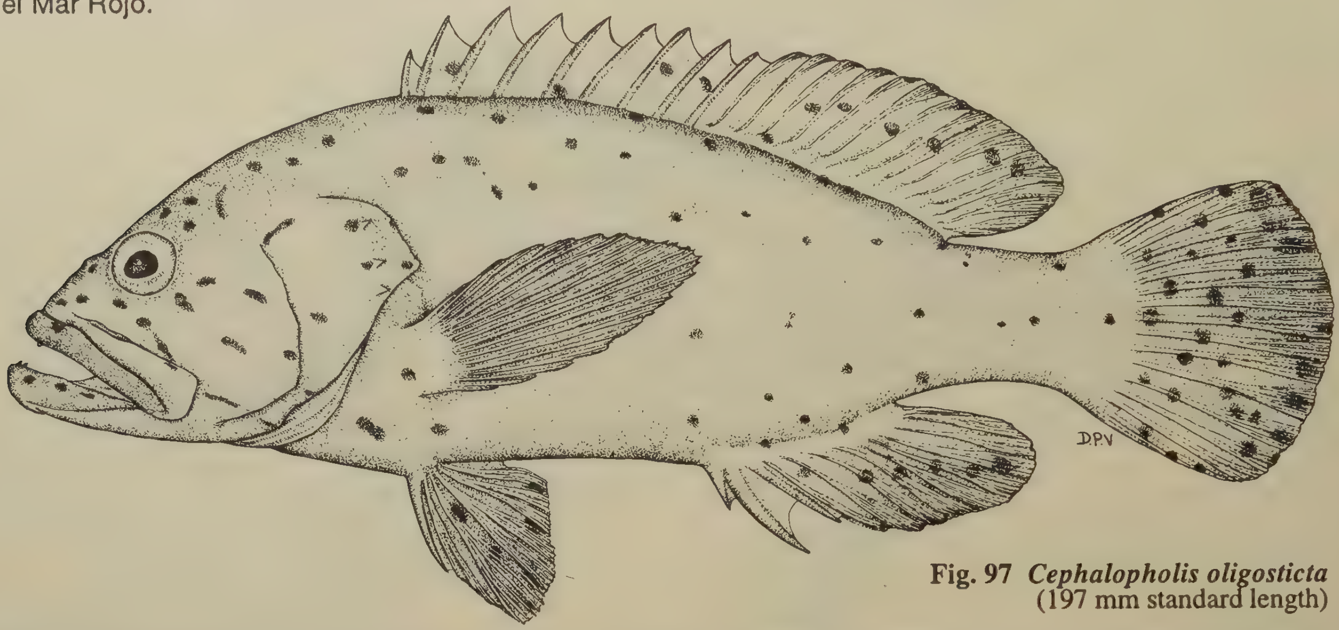


Fig. 97 *Cephalopholis oligosticta* (197 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.6 to 3.0 times in standard length (for fish 16 to 22 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area slightly convex, the width equal to orbit diameter on a fish of 19 cm standard length; preopercle rounded, finely serrate posteriorly, the lower edge more coarsely serrate; subopercle and interopercle also completely serrate; maxilla with a few scales, reaching well past eye. Gill rakers 7 or 8 on upper limb, 14 or 15 on lower limb. Dorsal fin with IX spines and 14 or 15 rays; anal fin with III spines and 9 rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.4 to 1.6 times in head length; pelvic fins reach about to anus, their length contained 1.6 to 2.0 in head length; caudal fin rounded. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 58 to 71; lateral-scale series 103 to 123. **Colour**: Orange-red, with widely scattered, small pale blue spots on head, body, and fins; soft dorsal, anal, and caudal fins usually with a narrow pale blue margin.

Geographical Distribution: Known only from the Red Sea, from Eilat in the Gulf of Aqaba to the Farasan Islands off the southern end of Saudi Arabia (Fig. 98).

Habitat and Biology: *C. oligosticta* seems to prefer a dead reef habitat with silty bottom in depths of 20 to 50 m. Randall and Ben-Tuvia (1983) reported ripe females of 17 and 19 cm standard length and a mature male of 22 cm standard length.

Size: Maximum total length at least 30 cm.

Interest to Fisheries: Probably none (because of its rarity and small size), except possibly as an aquarium novelty.

Local Names:

Literature: Heemstra and Randall (1984), Randall and Heemstra (1991).

Remarks: This species is probably most closely related to ***C. miniata***, which has more numerous blue spots, fewer lateral-line scales (47 to 56), ventral margin of preopercle smooth and covered by skin, and usually shorter pelvic fins (1.9 to 2.3 times in head length). Both species may be found at the same locality in the Red Sea (e.g., Eilat), but they occur in different habitats.

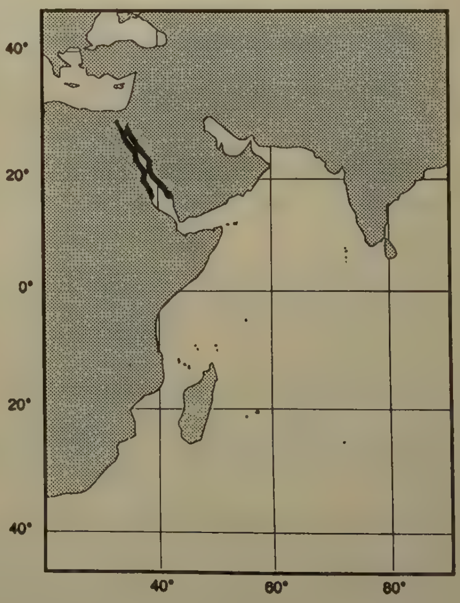


Fig. 98

Cephalopholis panamensis (Steindachner, 1876)

Fig. 99; Pl. IVD

SERRAN Cephal 18

Serranus panamensis Steindachner, 1876:551, pl. 1, fig. 1 (type locality: Pacific coast of Panama).

Synonyms: *Petrometopon panamensis*, *Epinephelus panamensis.*

FAO Names: **En** - Pacific graysby; **Fr** - Coné bande; **Sp** - Enjambre.

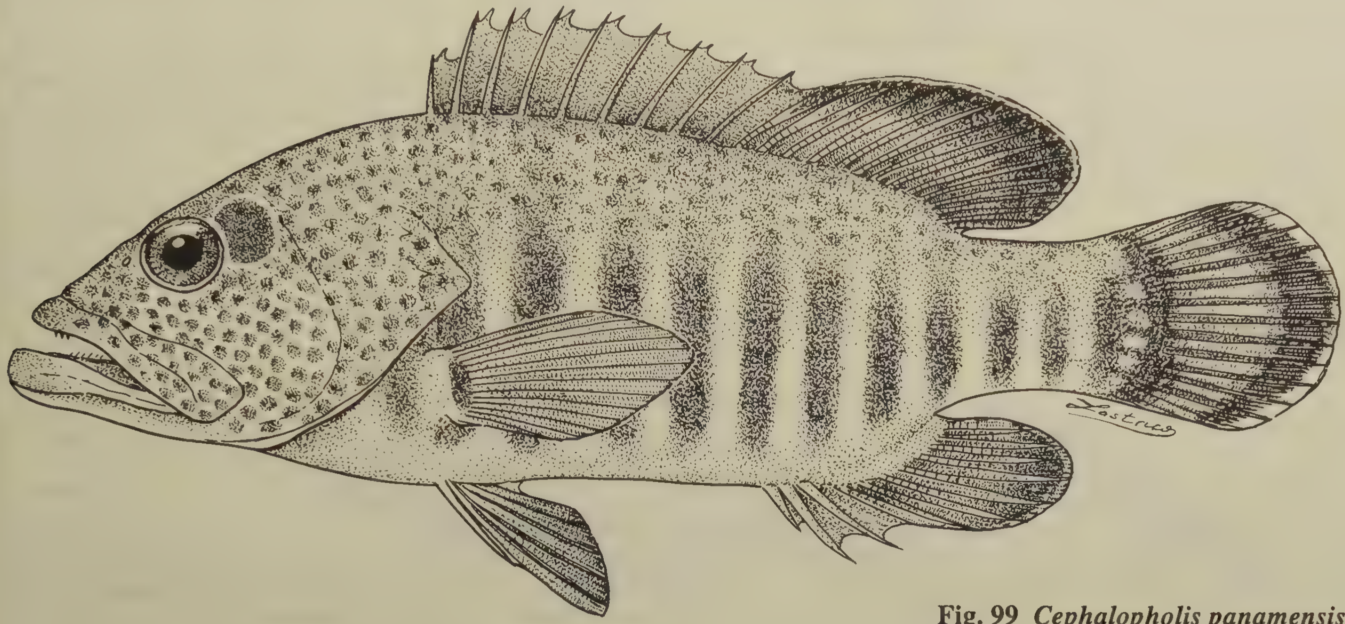


Fig. 99 *Cephalopholis panamensis* (adult)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.7 to 2.9 times in standard length (for fish 12 to 21 cm standard length). Head length contained 2.3 to 2.5 times in standard length; preopercle rounded, finely serrate; nostrils subequal. Gill rakers 16 to 19 (total). Dorsal fin with IX spines and 14 or 15 rays, the third spine longest, the membranes incised between the anterior spines; anal fin with III spines and 8 rays; pectoral-fin rays 17 or 18; pectoral fins clearly longer than pelvic fins, pectoral-fin length contained 1.5 to 1.7 times in head length; caudal fin rounded. Lateral-body scales strongly ctenoid; lateral-line scales 48 or 49; lateral-scale series 80 to 83. **Colour**: Head and body dark brownish, the body with 8 to 10 dark bars which are wider and more distinct ventrally; head, including maxilla and upper lip, with close-set reddish orange spots forming a bluish green reticulum; adults with a large dark brown spot immediately behind the eye; median fins edged with blue.

Geographical Distribution: Eastern Pacific from Gulf of California to Ecuador and the Galapagos (Fig. 100).

Habitat and Biology: Prefers coral reefs from shallow water to depths of 76 m. A shy, secretive species common along rocky shores of the Gulf of California.

Size: Maximum total length 30 cm.

Interest to Fisheries: *C. panamensis* is too small to be of commercial importance.

Local Names:

Literature: Smith (1971); Thomson et al. (1979).

Remarks: Lopez Lemus (1988) claims to have found electrophoretic data that indicate *Epinephelus labriformis* is more closely related to *C. panamensis* than to *E. analogus* or *E. acanthistius.* He assumes incorrectly that *C. panamensis* and *E. labriformis* are "subtropical" species with distributions that differ in some way from that of "the most tropical species," *E. acanthistius*. In fact, the distributions of all three species extend from the Gulf of California to Peru. The biogeographic analysis of Lopez Lemus is further confused when he assumes that the *E. analogus* species group "is completely of Indo-Pacific origin" and does not even mention C.L. Smith's (1971) determination that *E. analogus* is most closely related to *E. adscensionis* of the Atlantic

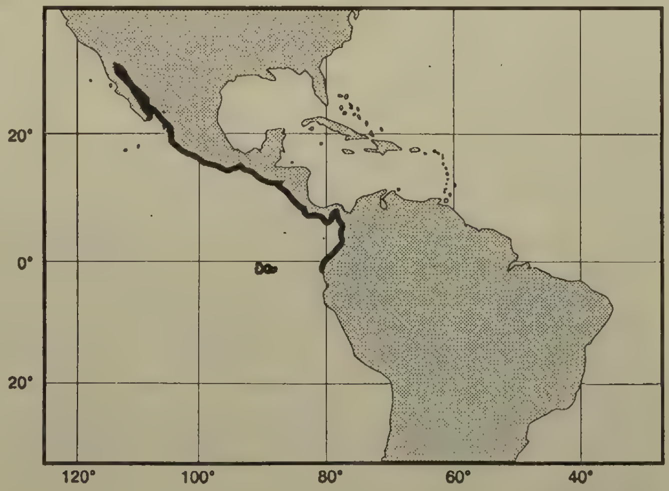


Fig. 100

Ocean. See the Remarks section of the account of ***E. labriformis*** (below) for further discussion of this electrophoretic work of Lopez Lemus.

Cephalopholis polleni (Bleeker, 1868) Fig. 101; Pl. IVE SERRAN Cephal 23

Epinephelus polleni Bleeker, 1868:336 (type locality: Réunion).

Synonyms: ***Plectropoma lineatum*** Steindachner in Bliss, 1883:45 (type locality: Mauritius). ***Cephalopholis virgatus*** Fourmanoir, 1954:214 (type locality: Anjouan, Comoro Islands). ***Gracila okinawae*** Katayama, 1974:101, fig. 2 (type locality: Naha, Okinawa, Japan).

FAO Names: En - Harlequin hind; **Fr** - Vielle arlequin; **Sp** - Cherna arlequin.

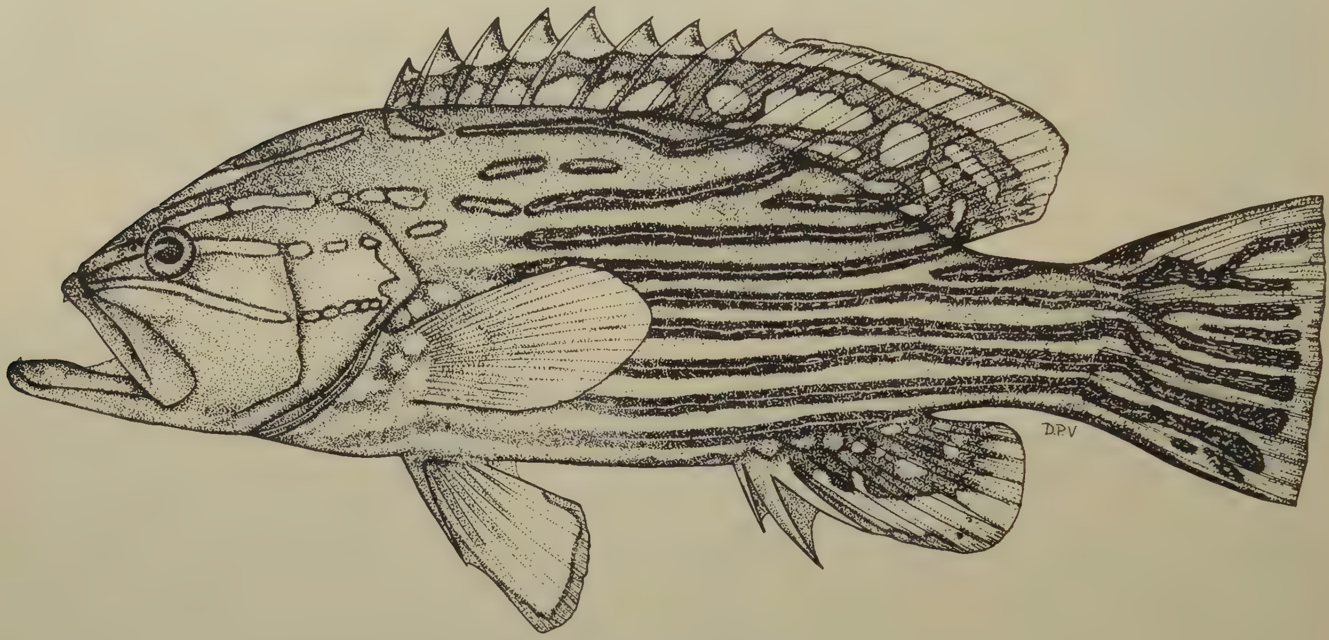


Fig. 101 *Cephalopholis polleni* (200 mm standard length)

Diagnostic Features: Body depth subequal to head length, depth contained 2.7 to 3.1 times in standard length (for fish 9 to 26 cm standard length). Eye diameter subequal to interorbital width and about twice depth of preorbital; preopercle rounded, finely serrate, the lower edge with 1 to 3 broad serrae; subopercle and interopercle finely serrate; maxilla reaches about to vertical at rear edge of eye. Gill rakers 7 or 8 on upper limb, 14 to 17 on lower limb. Dorsal fin with IX spines (with the fin membrane distinctly indented between them) and 14 to 16 rays; anal fin with III spines and 9 (rarely 8) rays; pectoral-fin rays 17 to 19; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.5 to 1.9 times in head length; caudal fin truncate to slightly emarginate. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 66 to 72; lateral-scale series 112 to 135. **Colour**: Adults mostly yellow (greenish or brownish yellow on head and anterodorsally on body in some fish), with 10 to 12 bright blue or violet horizontal stripes on body, the upper 2 or 3 broken into segments and extending posteriorly onto dorsal fin; the stripes running onto peduncle bifurcate and continue onto the caudal fin almost to the rear margin; head with 3 to 6 horizontal blue stripes; dark brown maxillary streak present; pelvic fins yellow with blue stripes. Small juveniles (4 cm standard length) yellowish brown, shading to lavender ventrally and to yellow at base of caudal fin, the yellow continuing as a broad band in each caudal lobe; snout yellow, with a large black spot on each side in front of nostrils. Larger juveniles (10 cm standard length) brownish orange with longitudinal purple stripes on head and body.

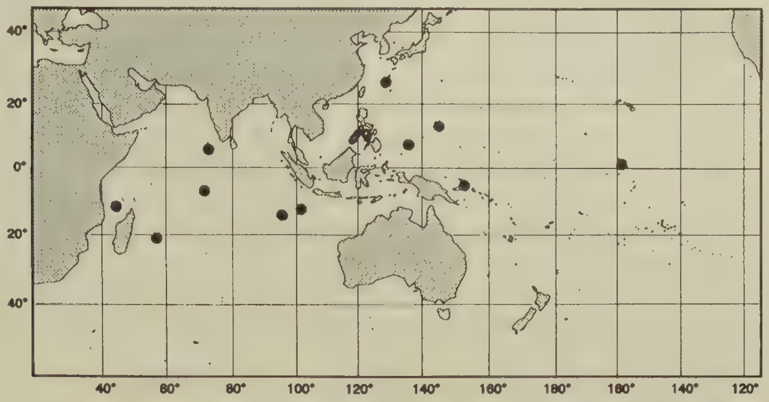


Fig. 102

Geographical Distribution: *C. polleni* occurs only at oceanic islands of the Indo-Pacific region, from the western Indian Ocean (Comoro Islands, Réunion, Mauritius, Chagos, Maldives) to the central Pacific (Palau and Line Islands); also reported from the Cocos-Keeling Islands, Christmas Island, Indonesia (small islands), Philippines, Okinawa, Guam, and New Britain. It is not known from the Red Sea, Sri Lanka, Australia, larger islands of Indonesia, or New Guinea (Fig. 102).

Habitat and Biology: *C. polleni* is found on coral reefs in clear water on the edge of steep drop-offs; rarely seen in less than 30 m, it has been taken in depths of 120 m and undoubtedly occurs deeper.

Size: Maximum total length 43 cm.

Interest to Fisheries: Probably valuable as an aquarium fish, but the species is apparently too rare and generally too small to be of commercial importance as a food fish. Caught with hook-and-line and in traps.

Local Names: JAPAN: Minamihata; PHILIPPINES: Blue-lined grouper.

Literature: Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Remarks: Smith-Vaniz et al. (1988) have shown that ***C. polleni***, which was previously assigned to the genus ***Gracila***, is not closely related to ***G. albomarginata***, the type species of this monotypic genus. The cranium of ***C. polleni*** is more similar to that of ***C. argus*** than to ***G. albomarginata***, and it also has more robust dorsal- and anal-fin spines than in ***G. albomarginata***. Although Smith-Vaniz et al. (1988) did not find any uniquely derived character that could be used to establish the monophyly of the genus ***Cephalopholis***, we provisionally accept their assignment of ***C. polleni*** to this genus, since it shares with the species of ***Cephalopholis*** a dorsal-fin spine count of IX, a distinct knob on the ventroposterior corner of the maxilla, and has 3 to 5 trisegmental pterygiophores in the dorsal and anal fins. Furthermore, ***C. polleni*** lacks the derived characters that distinguish the other grouper genera.

Cephalopholis sexmaculata (Rüppell, 1830)

Fig. 103; Pl. IVF

SERRAN Cephal 17

Serranus sexmaculatus Rüppell, 1830:107 (type locality: Red Sea).

Synonyms: ***Serranus zanana*** Valenciennes in Cuv. and Val., 1828:339 (type locality: Mauritius). ***Cephalopholis coatesi*** Whitley, 1937a:124, pl. 12 (type locality: off Townsville, Queensland, Australia). ***Cephalopholis gibbus*** Fourmanoir, 1954:215 (type locality: Mutsumudu, Anjouan, Comoro Islands).

FAO Names: **En** - Sixblotch hind; **Fr** - Vielle six taches; **Sp** - Cherna de seis manchas.

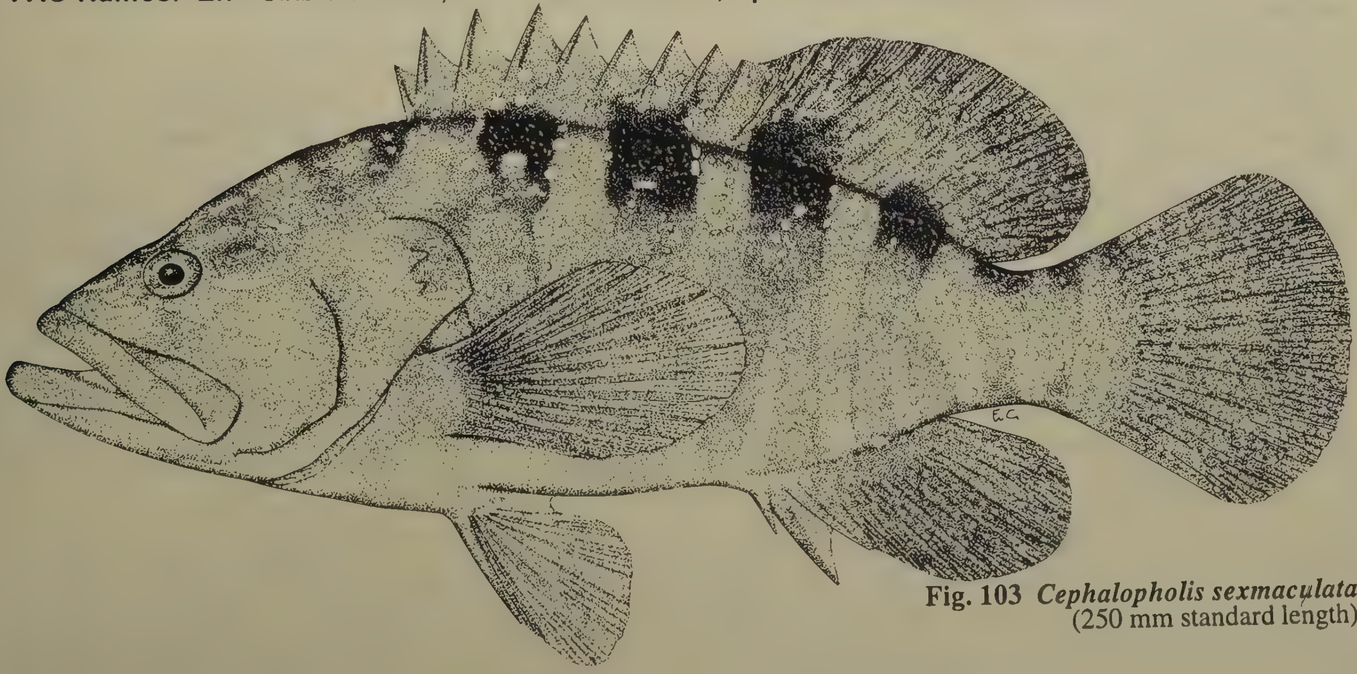


Fig. 103 *Cephalopholis sexmaculata* (250 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 3.0 times in standard length (for fish 13 to 39 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat to slightly convex; dorsal head profile of large specimens (more than 30 cm standard length) distinctly concave above the eyes; preopercle rounded, finely serrate in young, virtually smooth in large adults, the lower edge fleshy; subopercle and interopercle with a few small serrae mostly hidden by skin; maxilla scaly, reaching past eye. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with IX spines (the fin membranes distinctly indented between them) and 14 to 16 rays; anal fin rounded, with III spines and 9 rays; pectoral-fin rays 16 to 18; pectoral fins clearly longer than pelvic fins, pectoral-fin length contained 1.4 to 1.6 times in head length; pelvic-fin length contained 1.9 to 2.2 times in head length; caudal fin well rounded. Lateral-body scales ctenoid, without auxiliary scales (just a few in very large specimens); lateral-line scales 49 to 54; lateral-scale series 95 to 108. **Colour**: Orange-red, with small blue spots sparsely scattered on body but more densely on head and median fins; head also with elongated blue spots and lines; body with 4 dark bars (sometimes very faint) merging dorsally with blackish blotches at base of dorsal fin and extending onto the fin; 2 similar but smaller dark bar/blotches on caudal peduncle; the spaces between the dark body bars sometimes very pale; pectoral fins orange-red.

Geographical Distribution: Red Sea and Indo-Pacific from South Africa (southern Natal) to French Polynesia. Confirmed records from the Indian Ocean include Kenya, Zanzibar, Comoro Islands, Mauritius, Réunion, Maldives, Chagos Islands, and Christmas Island. The reports by Heemstra and Randall (1984) of *C. sexmaculata* from the Gulf of Oman, Pakistan, India, and Sri Lanka are unsubstantiated; it is absent from the Persian Gulf (Randall et al., 1978; Kuronuma and Abe, 1986) and is not yet known from Lakshadweep Islands (Jones and Kumaran, 1980) and the Seychelles (Smith and Smith, 1963). In the Pacific Ocean, *C. sexmaculata* is known from Indonesia, South China Sea, Philippines, southern Japan, Palau, Queensland, New Guinea, Solomon Islands, Caroline Islands, Mariana Islands, Marshall Islands, Line Islands, Fiji Islands, Society Islands, and the Marquesas (Fig. 104).

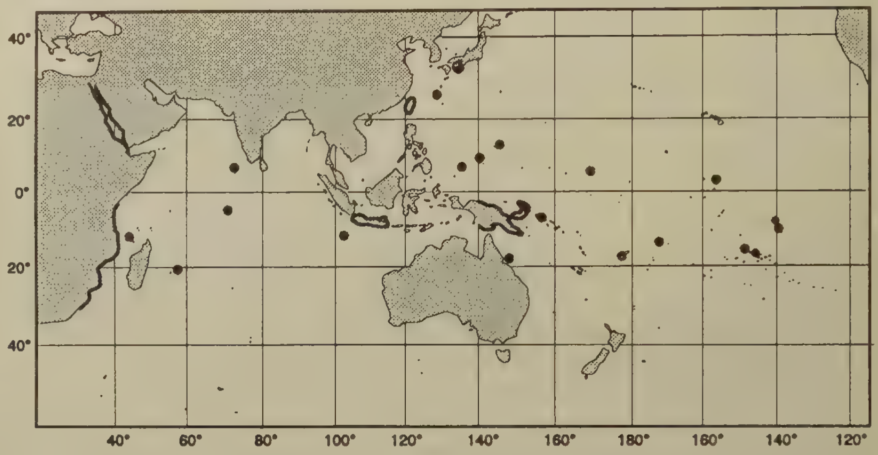


Fig. 104

Habitat and Biology: Coral reefs in depths of 10 to 150 m; a secretive species, generally seen hiding in caves and crevices on the outer reef slope. *C. sexmaculata* is active nocturnally in shallow water and diurnally in deeper water (Shpigel and Fishelson, 1989b). Randall and Brock (1960) found that this species (misidentified as *C. miniatus*) feeds mainly on fishes.

Size: Maximum total length at least 48 cm.

Interest to Fisheries: *C. sexmaculata* is of commercial interest to certain local fisheries. Caught with hook-and-line, traps, and spear.

Local Names: AUSTRALIA: Freckled rock cod; COMORO ISLANDS: Bandama (Ajouan); JAPAN: Kokuhanhata; PALAU: Bachungor; SOUTH AFRICA: Six-blotch rockcod; TAHITI: Rari, Tukorokoro.

Literature: Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Remarks: The species described as *Serranus zanana* by Valenciennes (1828) was recently found to be a senior synonym of *C. sexmaculata*, but it was not used as a valid species name for the past 150 years. Consequently, the International Commission on Zoological Nomenclature (1987: Opinion 1439) has rejected *Serranus zanana* in favour of the widely used *C. sexmaculata*.

Cephalopholis sonnerati (Valenciennes, 1828) Fig. 105; Pl. VA-C SERRAN Cephal 3

Serranus sonnerati Valenciennes in Cuv. and Val., 1828:299 (type locality: Pondicherry, India).

Synonyms: *Serranus zananella* Valenciennes in Cuv. and Val., 1828:304 (type locality: Fort Dauphine, Madagascar). *Epinephelus janthinopterus* Bleeker, 1874:40 (type locality: Ujung Pandang, Sulawesi, Indonesia). *Serranus unicolor* Liénard in Bleeker and Pollen, 1875:89 (based on "Mérou Unicolore" Liénard, 1839:31, Mauritius). *Cephalopholis purpureus* Fourmanoir, 1966:221, fig. 3 (type locality: Nha Trang, Viet Nam). Often misidentified as "*Cephalopholis aurantius*" or *C. formosanus*.

FAO Names: **En** - Tomato hind; **Fr** - Vielle ananas; **Sp** - Cherna piña.

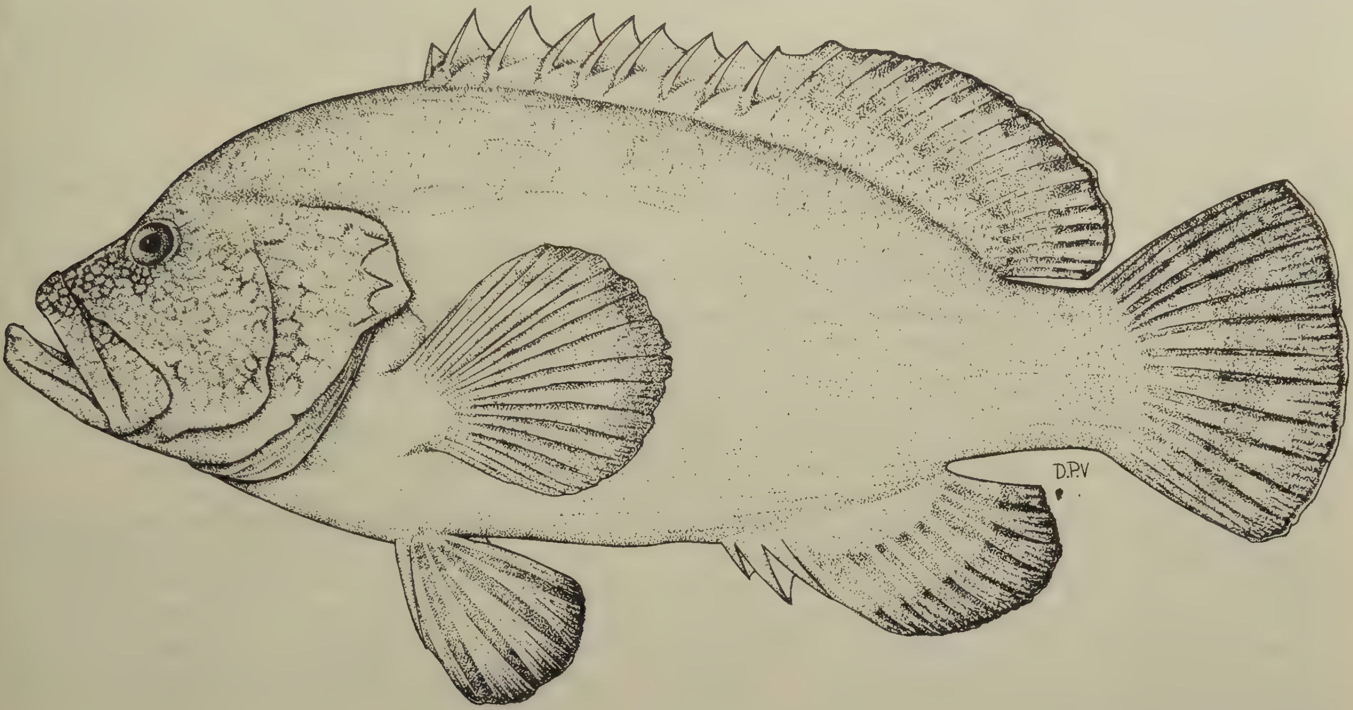


Fig. 105 *Cephalopholis sonnerati*
(300 mm standard length)

Diagnostic Features: Body depth greater than or subequal to head length, depth contained 2.3 to 2.8 times in standard length (for fish 9 to 41 cm standard length). Head length contained 2.5 to 2.7 times in standard length; dorsal head profile of adults straight to concave, the nape distinctly convex; interorbital area flat to slightly convex; preopercle rounded, finely serrate, with a shallow notch just above the "corner," the lower edge serrate or irregular with broad spinules, usually exposed; subopercle and interopercle finely serrate; maxilla reaches past eye. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with IX spines and 14 to 16 rays, the membranes distinctly indented between the spines; anal fin with III spines and 9 rays; pectoral fins with 18 to 20 rays; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.5 to 1.7 times in head length for fish 9 to 30 cm standard length (in fish larger than 30 cm standard length, the pelvic fins are longer than the pectoral fins); pelvic fins reaching or extending beyond anus; caudal fin rounded. Lateral-body scales ctenoid; lateral-line scales 66 to 80; lateral-scale series 115 to 134. **Colour**: Adults from the Indian Ocean with orange-red to reddish brown body, often with scattered small whitish or purple spots; purple network on head, maxilla, and lips; pectoral fins orange distally; membranes of soft dorsal, caudal, anal, and pelvic fins dusky; dorsal-fin rays orange distally; pelvic-fin tips blackish. Adults from the Pacific Ocean generally pale reddish to yellowish brown, covered with small brownish red or dark brown spots. Juveniles dark reddish brown to nearly black, the rear margin of the caudal fin and sometimes the pectoral fins whitish. A juvenile about 10 cm total length photographed in 30 m at Mauritius shows yellow spots on the head, scattered blackish spots (which could be quickly changed to pale greenish) on the body and oblique white stripes on the caudal fin somewhat like *C. urodeta*. Larger juveniles are brownish orange with scattered pale greenish spots on the body and a black spot between the upper and middle opercular spines.

Geographical Distribution: Indo-Pacific from the east coast of Africa (from Socotra to Durban) to the Line Islands in the central Pacific; in the western Pacific, *C. sonnerati* ranges from southern Japan to southern Queensland. It is known from both continental and insular localities, including most of the islands in the tropical Indian and Pacific Oceans, but it has not been reported from the Red Sea or Persian Gulf. And it was not found at the Chagos Archipelago, despite an intensive survey there (Winterbottom et al., 1989) (Fig. 106).

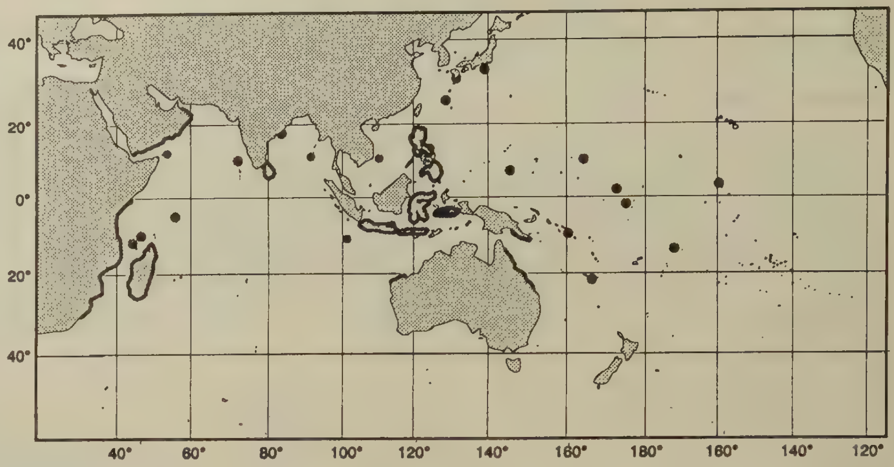


Fig. 106

Habitat and Biology: *C. sonnerati* is a coral reef species usually caught in depths of 30 to 100 m, but at Madagascar it occurs in depths of 10 to 20 m. It feeds on fishes and crustaceans. According to Morgans (1982), females mature at about 28 cm standard length and males at about 34 cm.

Size: Maximum total length recorded for *C. sonnerati* is 57 cm.

Interest to Fisheries: This common and widespread species is of commercial importance throughout most of its range. It is caught with hook-and-line and in traps.

Local Names: INDIA: Bontoo (Telugu), Siggapu-cullawah (Tamil), Ryfana (Minicoy), Chencheerachammam (Lakshadweep Islands); MADAGASCAR: Alovo; MOZAMBIQUE: Garoupa, Xissumba, Guitongue.

Literature: Harmelin-Vivien and Bouchon (1976); Randall (1986); Randall and Heemstra (1991).

Remarks: Allen (1985: fig. 122) published an underwater photograph (labelled "*Epinephelus multinotatus*") of what appears to be an unusually coloured specimen of *C. sonnerati* from the North West Cape of Western Australia. The ground colour is brownish, the head, body, and most of the fins covered with small dark brown spots; several large, irregular whitish blotches on the body and posteriorly on the head, those on the body aligned in 5 or 6 vertical or slightly oblique series, the last two on the caudal peduncle; a few scattered white spots on the body and more densely on the median fins. Judging from the differences in colour patterns of *C. sonnerati* in the Indian and Pacific Oceans, there are some genetic differences in the populations of these two areas; but we have not been able to find any morphological differences in specimens from these two areas.

Cephalopholis spiloparaea (Valenciennes, 1828)

Fig. 107; Pl. VD

SERRAN Cephal 8

Serranus spiloparaeus Valenciennes in Cuv. and Val., 1828:338 (type locality unknown, but the holotype was collected by Commerson, hence probably Indian Ocean).

Synonyms: None. But often misidentified as *C. analis* (e.g., Heemstra and Randall, 1984; Randall, 1986) or *C. aurantia* (e.g., Russell, 1983; Katayama, 1988; Masuda and Allen, 1987).

FAO Names: **En** - Strawberry hind; **Fr** - Vielle fraise; **Sp** - Cherna frutillera.

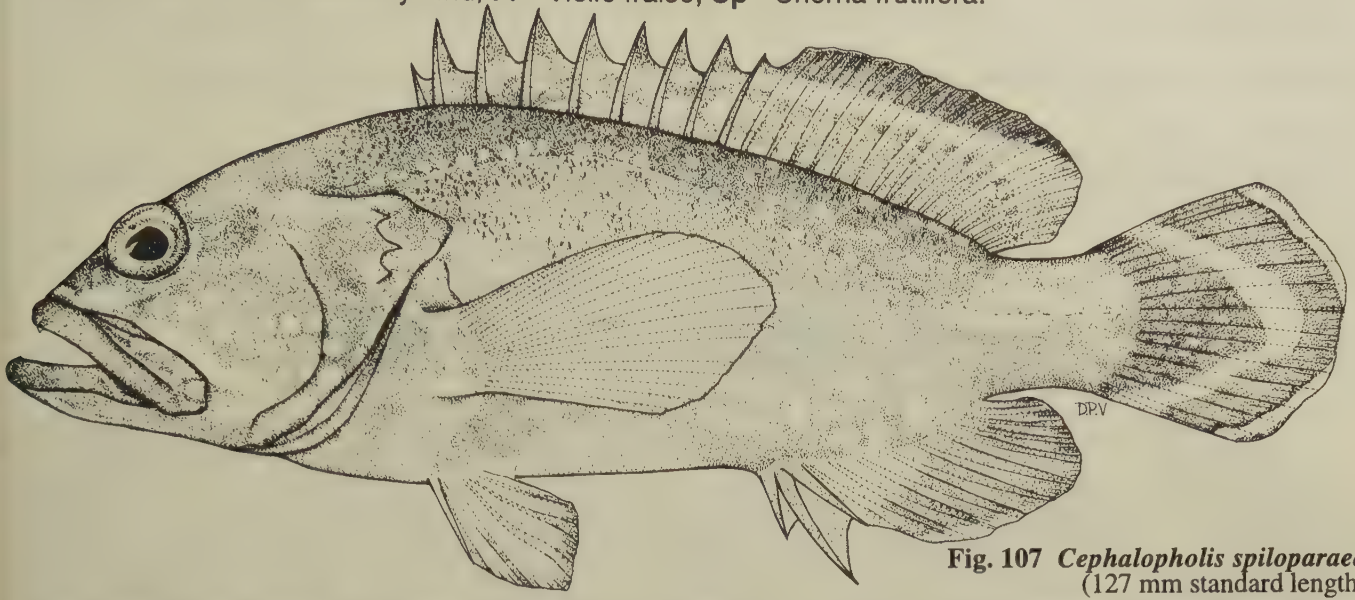


Fig. 107 ***Cephalopholis spiloparaea***
(127 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 3.2 times in standard length (for fish 9 to 17 cm standard length). Head length contained 2.3 to 2.5 times in standard length; eye large, its diameter about twice depth of preorbital; interorbital area flat; preopercle rounded, very finely serrate, with a shallow notch, the lower edge fleshy; subopercle and interopercle smooth or with minute serrae; maxilla scaly, reaching to or well beyond vertical at rear edge of eye. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with IX spines and 14 to 16 rays; anal fin with III spines and 9 rays; pectoral-fin rays 17 to 19, rarely 19; pectoral fins clearly longer than pelvic fins, pectoral-fin length contained 1.3 to 1.6 times in head length; pelvic fins not reaching anus, their length contained 1.9 to 2.2 times in head length; caudal fin rounded. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 47 to 53; lateral-scale series 84 to 103. **Colour**: Pale reddish orange, mottled and blotched with dark red or brownish red; faint pale spots usually present on head, body, and median fins; caudal fin usually coloured like the body (but distinctly yellowish in some fish from the Comoro Islands) and with a bluish white submarginal band at corners of fin, becoming narrow and marginal (or even disappearing) at centre of fin; ventral margin of soft portion of anal fin (and to lesser extent the dorsal fin) bluish, usually persisting as dusky in preserved specimens; some fish with about 8 faint dark saddle blotches at base of dorsal fin and another on front of caudal peduncle.

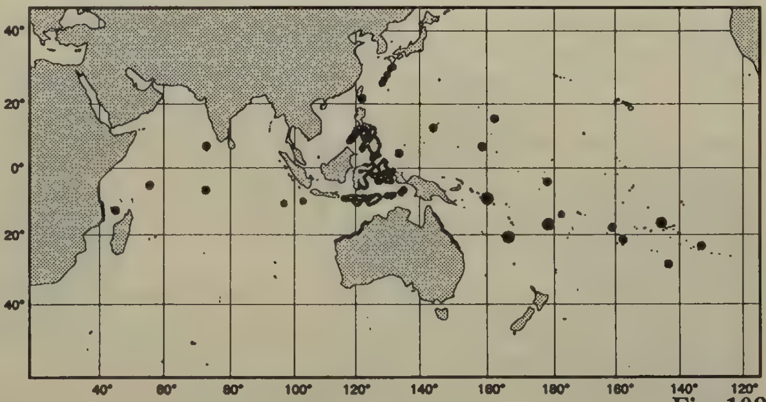


Fig. 108

Geographical Distribution: Indo-Pacific from Pinda, Mozambique (15°S) to French Polynesia and the Pitcairn Group; in the western Pacific, *C. spiloparaea* ranges from the Ryukyu Islands of Japan to Heron Island at the southern end of the Great Barrier Reef. Except for the specimens collected at Pinda, this species is known only from insular localities (Fig. 108).

Habitat and Biology: Perhaps the most common species of grouper on Indo-Pacific coral reefs below 40 m; specimens have been collected in depths of 15 to 108 m. It appears that nothing is known of the biology of this species.

Size: Maximum total length 22 cm.

Interest to Fisheries: Because of its small size and relatively deep habitat, this grouper is of little commercial importance.

Local Names: JAPAN: Akahana.

Literature: Heemstra and Randall (1986); Myers (1989); Randall and Heemstra (1991).

Remarks: *C. spiloparaea* is similar to *C. aurantia* and has often been misidentified as *C. aurantia* (or as *C. analis*, a junior synonym of *C. aurantia*). These two species differ in colour (*C. aurantia* is generally orange-yellow or golden, with red to orange dots on head and dorsally on body), and the pelvic fins of *C. aurantia* are longer, usually reaching the anus, their length 1.6 to 2.0 times in head length.

Cephalopholis taeniops (Valenciennes, 1828)

Fig. 109; Pl. VE

SERRAN Cephal 7

Serranus taeniops Valenciennes in Cuv. and Val., 1828:307 (type locality: Cape Verde Islands).

Synonyms: None.

FAO Names: **En** - African hind (formerly: Bluespotted seabass); **Fr** - Mérou Africain (formerly: Mérou à points bleus); **Sp** - Cherna colorada.

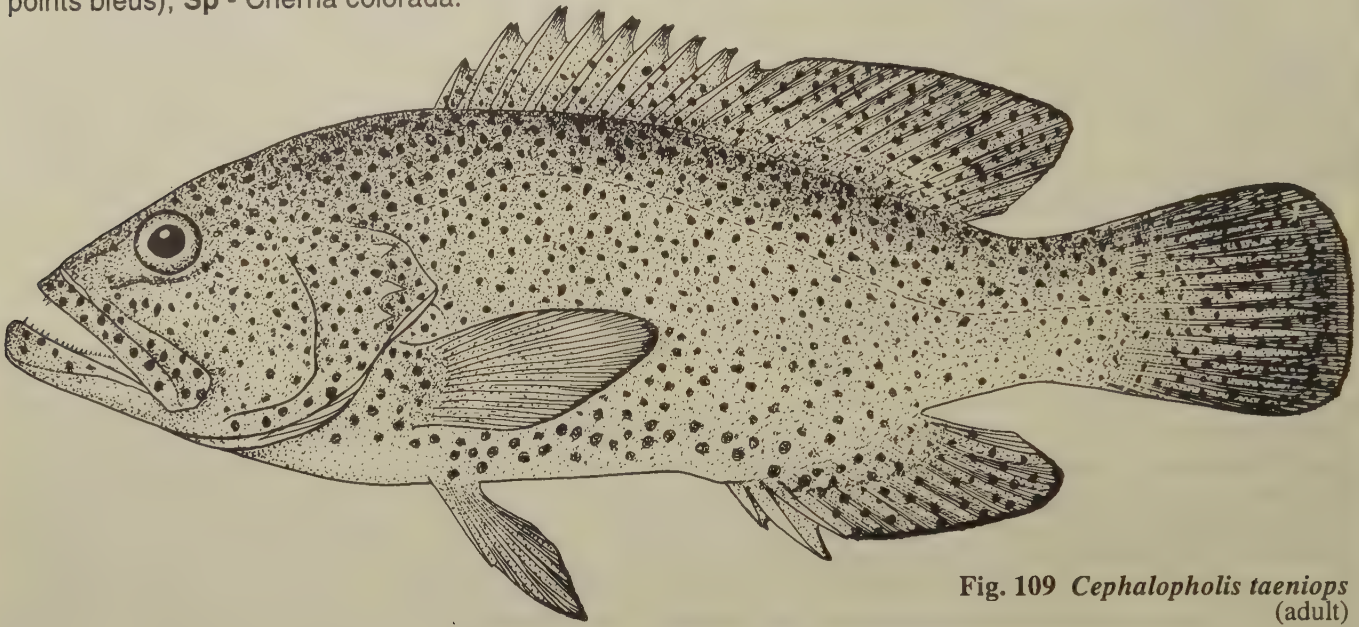


Fig. 109 ***Cephalopholis taeniops*** (adult)

Diagnostic Features: Body depth less than head length, depth contained 2.8 to 3.2 times in standard length (for fish 22 to 34 cm standard length). Head length contained 2.7 to 3.0 times in standard length; interorbital area convex; preopercle rounded, finely serrate, with a shallow notch, the lower edge fleshy; subopercle and interopercle with a few small serrae covered by skin; maxilla reaching vertical at rear edge of eye or beyond. Gill rakers 8 on upper limb, 15 or 16 on lower limb. Dorsal fin with IX spines and 15 or 16 rays, the fin membranes distinctly indented between the spines; anal fin with III spines and 9 or 10 rays; pectoral-fin rays 18 or 19; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.5 to 1.7 times in head length; pelvic fins reaching or nearly reaching anus; caudal fin rounded. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 68 to 72; lateral-scale series 114 to 122. **Colour**: Reddish orange, the head, body, and median fins covered with small blue spots; fins blackish distally, the soft dorsal, caudal, and anal fins with a narrow bluish margin; horizontal blue line just below eye. According to Séret (1981), there is a black variety that also has blue spots; it is much less common than the orange variety.

Geographical Distribution: Eastern Atlantic from West Sahara to Angola, including the Cape Verde Islands, Principe Island, and São Tomé Island (Fig. 110).

Habitat and Biology: Sandy and rocky bottoms in depths of 20 to 200 m. It appears that nothing has been published on the biology of *C. taeniops*.

Size: Said to reach 70 cm total length, but this is unusually large for a species of *Cephalopholis*. According to Séret (1981), it attains 40 cm total length.

Interest to Fisheries: Probably of some commercial importance in local fisheries. Caught with hook-and-line and in trawls. *C. taeniops* is now imported from Senegal and marketed in France. It is also the subject of an important fishery at Dakar.

Local Names: ANGOLA: Garoupa-de-pintas, Garoupa encarnada, Donaquira; SENEGAL: Dojh, Khonkhé, Kêle; TOGO: Agnato.

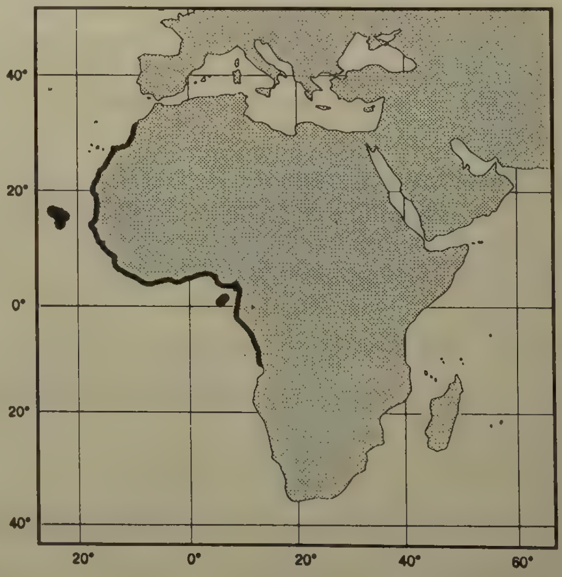


Fig. 110

Literature: Boulenger (1895); Fowler (1936); Cadenat (1951); Poll (1954); Bianchi (1986); Bellemans et al. (1988); Schneider (1990); Heemstra (1991).

Cephalopholis urodeta (Schneider, 1801)

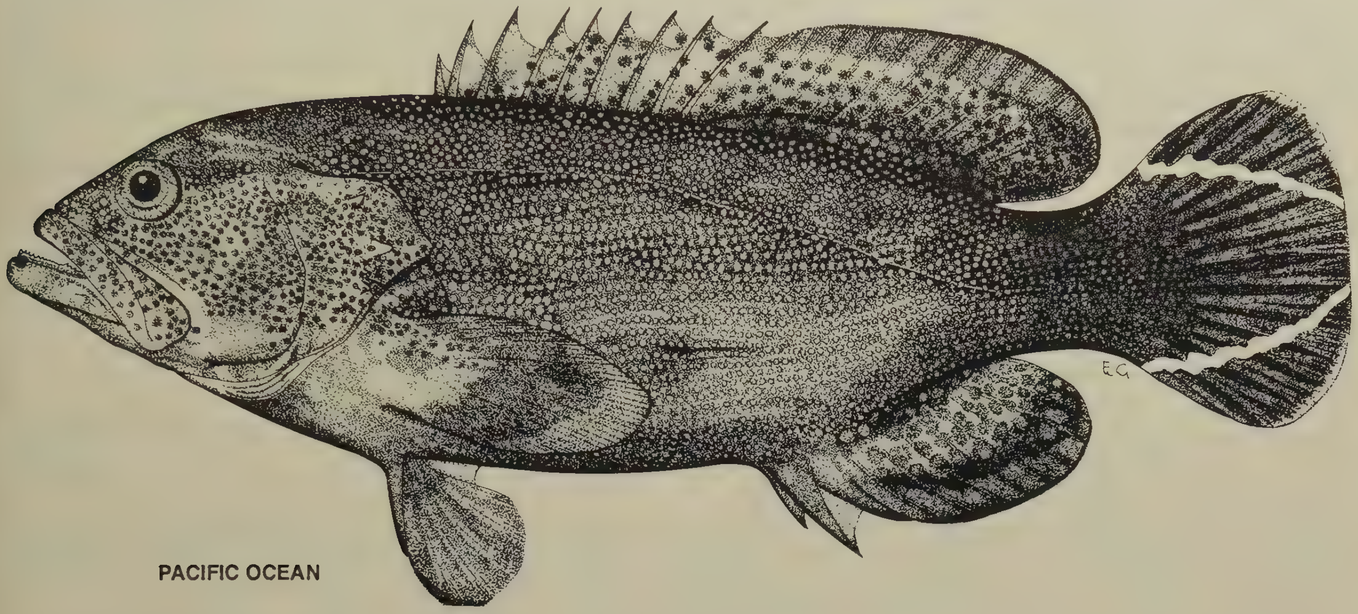
Fig. 111; Pls VF, VIA

SERRAN Cephal 15

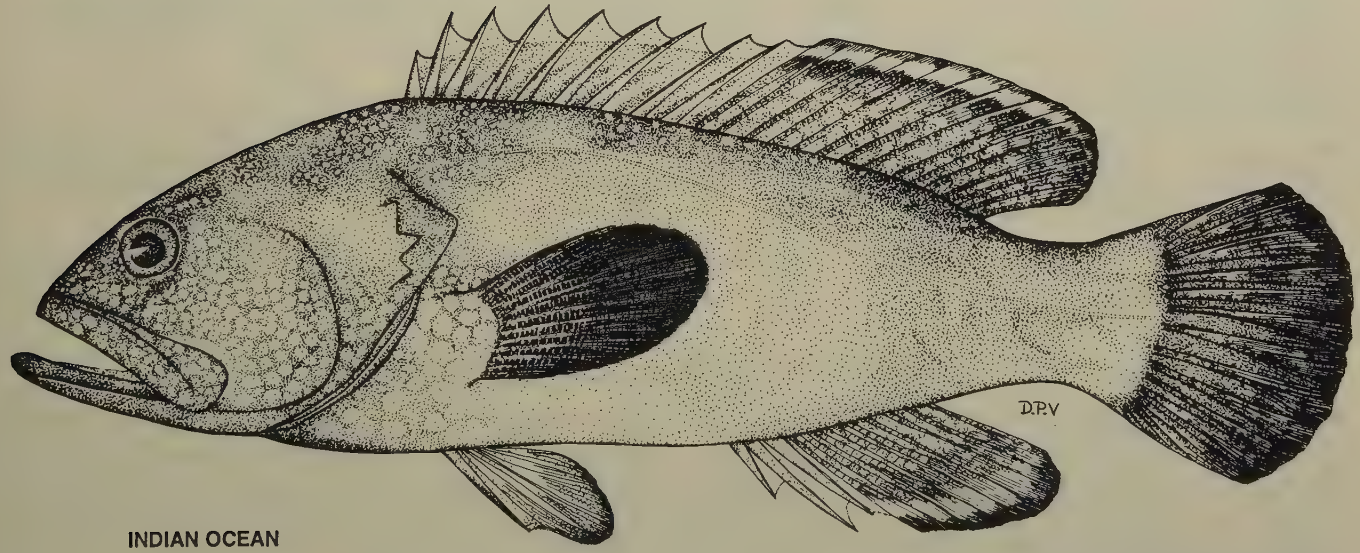
Percam urodetam Schneider in Bloch and Schneider, 1801:333 (type locality: St. Christina, Marquesas Islands, Pacific Ocean; from Forster's manuscript).

Synonyms: ***Serranus nigripinnis*** Valenciennes in Cuv. and Val., 1828:339 (type locality unknown, from Commerson, hence probably Indian Ocean). ***Serranus erythraeus*** Valenciennes in Cuv. and Val., 1830:516 (type locality: Réunion). ***Perca urodeta*** Forster, 1844:221 (type locality: St. Christina, Marquesas). ***Epinephelus Playfayri*** Bleeker, 1879:2 (type locality: Mauritius). ***Serranus mars*** De Vis, 1884a:390 (type locality: Cardwell, Queensland). ***Cephalopholis nigripinnis*** for Indian Ocean specimens (e.g., Heemstra and Randall, 1984, 1986; Randall, 1987; Winterbottom et al., 1989)

FAO Names: En - Darkfin hind (formerly: Duskyfin hind); **Fr** - Vielle aile noire; **Sp** - Cherna alinegra.



PACIFIC OCEAN



INDIAN OCEAN

Fig. 111 *Cephalopholis urodeta*
(Pacific ocean form 180 mm standard length, Indian ocean form 180 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.7 to 3.3 times in standard length (for fish 9 to 21 cm standard length). Head length contained 2.4 to 2.7 times in standard length; interorbital area convex; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle usually smooth; maxilla reaching well past eye. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb. Dorsal fin with IX spines and 14 to 16 rays; anal fin with III spines and 9 (rarely 8) rays; pectoral-fin rays 17 to 19; pectoral fins distinctly longer than pelvic fins, pectoral-fin length contained 1.3 to 1.7 times in head length; pelvic fins usually not reaching anus, pelvic-fin length contained 1.8 to 2.3 times in head length; caudal fin rounded. Snout and maxilla with minute cycloid scales, lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 54 to 68; lateral-scale series 88 to 108. **Colour**: Reddish brown to brownish red, darker posteriorly; body sometimes with small pale spots and/or 4 faint, irregular, dark bars that bifurcate ventrally and another two dark bars on caudal peduncle; head with numerous, small, close-set orange-red spots (more evident on paler parts of head) and sometimes with irregular reddish brown blotches; dark spot between upper and middle opercular spines (more evident on juveniles); a pair of small dark spots on edge of lower lip in line with the pair of anterior canine teeth; soft dorsal and anal fins with small orange-red spots; outer triangular part of interspinous dorsal-fin membranes orange; pelvic fins orange-red, usually with a dark blue edge. Caudal fin of Indian Ocean fish dark reddish brown to almost black and covered with small pale spots; caudal fin of Pacific fish (larger than 4 cm standard length) with 2 white to bluish white bands that converge posteriorly, the area between the bands dark, often with pale spots, the outer corners of the fin red, with a whitish margin. Pectoral fins of Indian Ocean fish coloured like body basally, becoming dark brown to almost black distally; pectoral fins of Pacific fish reddish brown basally, becoming yellow distally. Some fish from dark habitats in the Comoro Islands are uniformly black.

Geographical Distribution: Indian Ocean from the coast of Africa (Kenya to northern South Africa) to French Polynesia and the Pitcairn Islands; not known from the Red Sea, Gulf of Aden, Gulf of Oman, Persian Gulf, or the coast of India. *C. urodeta* is a widespread and common species that probably occurs at all of the tropical islands and shallow banks of the Indian and west-central Pacific Oceans. It is also known from the northern coast of Australia. Although we have seen one specimen (USNM, 118 mm standard length) from Sri Lanka, and the species occurs at the nearby Maldive Islands, it appears to be absent from the entire Arabian/Asian coast of the Indian Ocean (Fig. 112). The specimens from Muscat (Oman) that Boulenger (1895:188 or 189) referred to "*Epinephelus nigripinnis*" are probably *C. hemistiktos*; they are certainly too large to be *C. urodeta*.

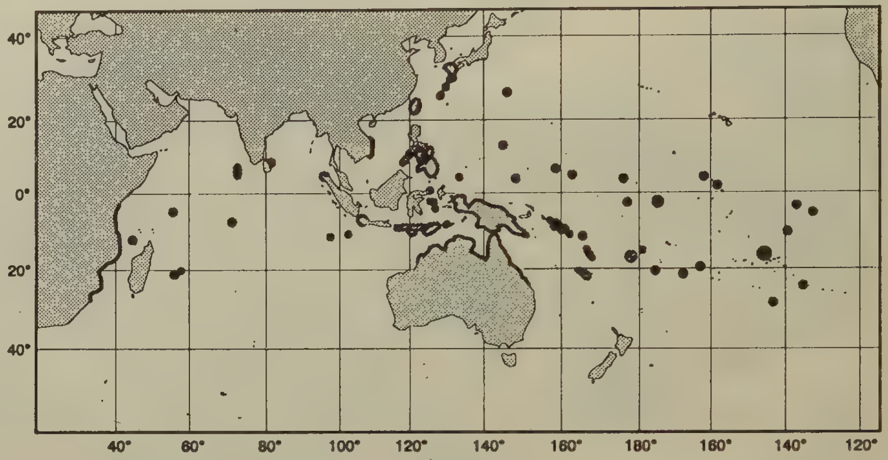


Fig. 112

Habitat and Biology: This is a common coral reef species that is usually seen in outer reef areas, but also found in lagoons, back-reef areas, and on the reef-top. It has been collected in depths of 1 to 60 m. Randall and Brock (1960) found that it feeds mainly on fishes (68%) and crustaceans.

Size: Maximum total length 28 cm.

Interest to Fisheries: Because of its small size, *C. urodeta* is not of much interest as a food fish (except perhaps to subsistence fisheries), but it does well in an aquarium and may find a market as an aquarium fish. Caught with hook-and-line and in traps.

Local Names: AUSTRALIA: Flag-tailed rockcod; HONG KONG: Banded-tail coral-cod, Pak-mei-paan; JAPAN: Nijihata; MICRONESIA: Flagtail grouper; PALAU: Ollos; PHILIPPINES: Flag-tailed grouper, Suno (Visayan); TAHITI: Rero.

Literature: Myers (1989); Winterbottom et al. (1989); Randall and Heemstra (1991).

Remarks: We have been unable to find any morphological character to separate the Pacific and Indian Ocean populations of this species. Although these two populations are mostly allopathic, there does seem to be some overlap in the western Indonesia area (we have seen specimens from Jakarta and the western end of Sumatera that lack the white bands on the tail). Intermediate specimens, with a series of pale spots in place of the white caudal bands, as well as typically white-banded fish, occur at Christmas Island in the eastern Indian Ocean (Allen and Steene, 1988).

Cromileptes Swainson, 1839

SERRAN Cromil

Cromileptes Swainson, 1839:201; type species, "*Cromileptes altivelis* Swns." (= *Serranus altivelis* Valenciennes, 1828) by subsequent designation of Bleeker, 1875:257.

Synonyms: *Serranichthys* Bleeker, 1855b:344; type species, *Serranus altivelis* Valenciennes by monotypy. *Chromileptes* (variant spelling).

Species: A single species known from western Pacific and Indian oceans.

Remarks: The monotypic genus *Cromileptes* is quite distinct from other grouper genera. The shape of the head (anteriorly depressed and posteriorly elevated) is unique among serranid fishes. No other Indo-West Pacific grouper has X dorsal-fin spines, and no grouper has such an elevated dorsal fin (with the posterior spines and anterior rays longest). The affinities of *Cromileptes* with other serranid genera are unclear.

Cromileptes altivelis (Valenciennes, 1828)

Fig. 113; Pl. VIB

SERRAN Cromil 1

Serranus altivelis Valenciennes in Cuv. and Val., 1828:324, pl. 35 (type locality: Java).

Synonyms: None.

FAO Names: **En** - Humpback grouper; **Fr** - Mérou bossu; **Sp** - Mero jorobado.

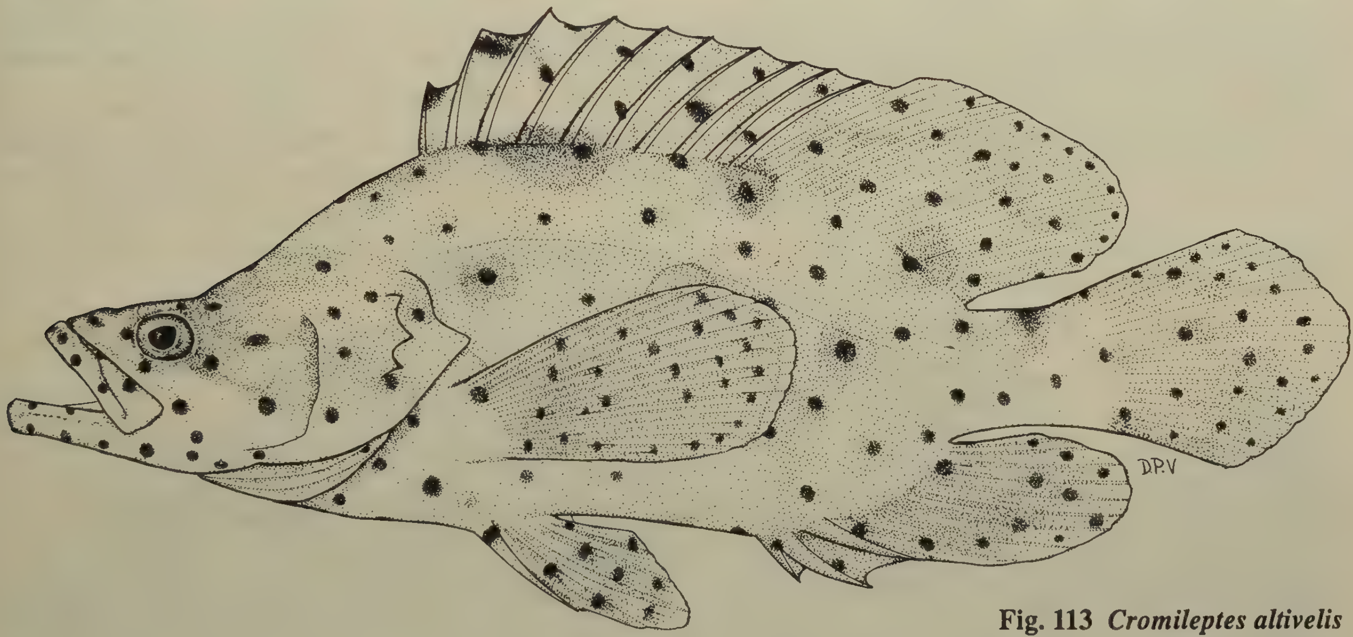


Fig. 113 ***Cromileptes altivelis***
(about 300 mm standard length)

Diagnostic Features: Body compressed, the depth less than head length, and contained 2.6 to 3.0 times in standard length (for fish 12 to 37 cm standard length); body width contained 2.4 to 2.6 times in the depth. Head length contained 2.5 to 2.8 times in standard length; dorsal head profile distinctly concave, rising steeply at the nape; preorbital very narrow, its depth contained about 5 times in eye diameter and 30 to 32 times in head length; preopercle finely serrate, the serrae at the angle slightly enlarged, the lower edge smooth; opercle with middle spine inconspicuous, the upper and lower spines rudimentary; posterior nostril a large, crescentic, vertical slit; maxilla extending to below rear half of eye; no step or knob on ventral edge of maxilla; supramaxilla well developed; jaws with bands of villiform teeth; no canines; palatines with teeth. Gill rakers short, 8 to 11 on upper limb, 13 to 17 on lower limb. Dorsal fin with X spines and 17 to 19 rays, the fin origin over opercle, the fin membranes not incised between the spines, the posterior spines longest and the soft-rays even longer; anal fin with III spines and 9 or 10 rays; pectoral fins rounded, with 17 or 18 rays; the middle rays longest; caudal fin rounded, with 8 branched rays and 8 procurrent rays in upper part and 7 branched rays and 8 procurrent rays in lower part. Scales on body smooth (the ctenii greatly reduced); lateral-line scales 54 to 62; lateral-scale series 106 to 122. Pyloric caeca 13. Supraneural bones slender, the second more than half length of first; no trisegmental pterygiophores in dorsal or anal fins; rear edge of first dorsal pterygiophore slightly excavated; epipleural ribs on vertebrae 1 to 8; cranium elongate, depressed anteriorly and elevated posteriorly; least interorbital width about 10% of cranium length; postorbital part of cranium elongated, 60% or more of cranium length; supraoccipital crest not extending onto frontals. **Colour**: Pale greenish brown, with widely-spaced, round, black spots on head, body, and fins; some spots on body and base of median fins overlain by a large dusky blotch. Black spots on juveniles fewer than on adults and may be as large or larger than eye.

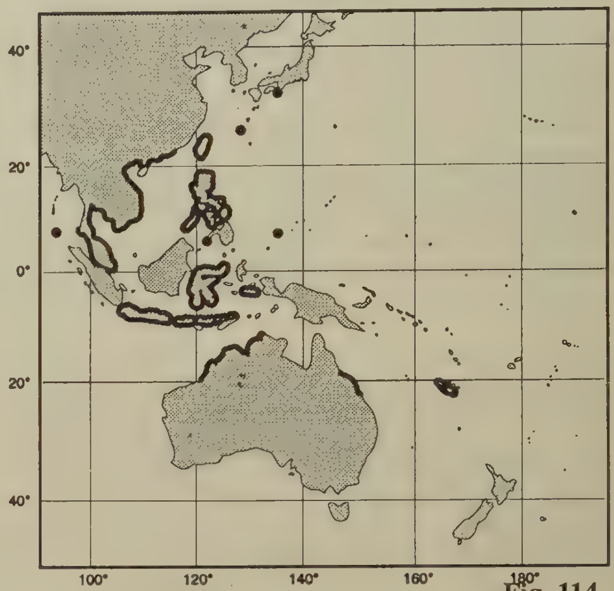


Fig. 114

Geographical Distribution: Western Pacific from southern Japan to Palau, Guam, New Caledonia, and southern Queensland (Australia); in the eastern Indian Ocean from the Nicobars to Broome, Western Australia (Fig. 114). Reports of *Cromileptes* from the western Indian Ocean (Heemstra and Randall, 1984, 1986) are unsubstantiated, although one by Smith (1954) from Kenya seems valid. Records from the Hawaiian Islands are probably based on released aquarium fishes (Randall and Heemstra, 1991).

Habitat and Biology: *Cromileptes* occurs on well-developed coral reefs as well as in dead or silty reef areas. It is found in tide pools and is also caught at depths of 40 m. Artificial spawning was accomplished by Tang et al. (1979). Mature eggs were buoyant, 0.80 to 0.83 mm in diameter with a single oil droplet; the larvae died after 7 days. Growth of *Cromileptes* in captivity is very slow.

Size: Maximum 70 cm total length.

Interest to Fisheries: Juveniles are prized as aquarium fishes, and adults are one of the most expensive fishes in fish markets wherever it occurs. *C. altivelis* may have potential as a species for aquaculture. Caught with hook-and-line, spear, and in traps.

Local Names: AUSTRALIA: Barramundi cod; JAPAN: Sarasa-hata; PALAU: Meleches; PHILIPPINES: Lapu-lapung Señorita (Tagalog), Miro-miro (Visayan); SINGAPORE: Polka-dot grouper, Kerapu tikus. In the aquarium trade, this species is often called "panther fish."

Literature: Schroeder (1980); Grant (1982); Tan et al. (1982); Heemstra and Randall (1984, 1986); Myers (1989); Randall and Heemstra (1991).

Dermatolepis Gill, 1862

SERRAN Dermat

Dermatolepis Gill, 1862a:54; type species, ***Dermatolepis punctatus*** Gill, 1862 (= ***D. dermatolepis***) by original designation.

Synonyms: *Lioperca* Gill, 1863:236; type species, ***Serranus inermis*** Valenciennes, 1828 by monotypy.

Diagnostic Features: Body deep and markedly compressed, the greatest depth usually more than head length (occasionally equals head length) and contained 2.1 to 2.5 times in standard length, the body width contained 2.4 to 3.4 times in the depth. Head length contained 2.5 to 2.8 times in standard length; dorsal head profile steep, almost straight; the interorbital area slightly convex; preorbital depth contained 8 to 11 times in head length; preopercle subangular, finely serrate, the serrae covered by skin and the lower edge smooth; opercular spines inconspicuous, the lower rudimentary; upper edge of operculum convex; ventral edge of subopercle and interopercle smooth; anterior part of interopercle extended ventrally as a broad fleshy flap; no bony knob or step on posterior end of maxilla; supramaxilla well developed; posterior nostrils 2 or 3 times larger than anterior nostrils; canines at front of jaws rudimentary or absent; teeth present on palatines. Dorsal fin with XI spines and 18 to 20 rays, the fin origin in front of a vertical at pectoral-fin base, the fin membranes not or only slightly incised between the spines; anal fin with III spines and 9 or 10 rays; pectoral fins rounded, the middle rays longest, distinctly longer than pelvic fins; caudal fin rounded in juveniles, truncate to distinctly concave in adults, with 8 branched rays and 8 procurrent rays in upper part and 7 branched rays and 7 procurrent rays in lower part. All scales on the body and head are smooth (ctenii rudimentary or absent). Supraneural bones 2, the second one at least half the length of the first; no trisegmental pterygiophores; rear edge of first dorsal pterygiophore not excavated; epipleural ribs on vertebrae 1 to 10; cranium compressed, the least interorbital width less than width of vomer; median supraoccipital crest well developed; frontoparietal crests convergent anteriorly; parasphenoid straight.

Habitat and Biology: Species of *Dermatolepis* are secretive coral-reef fishes reported from depths of 10 to 213 m. They are relatively rare and almost nothing is known of their biology.

Geographical Distribution: One species in the eastern Pacific, one in the western Atlantic, and one in the western Indian Ocean. This particular pattern of species distribution is not known for any other genus of fishes.

Interest to Fisheries: Taken incidentally with other species; caught with hook-and-line, spear, and in traps. Because of their rarity, the species of *Dermatolepis* are of little commercial importance.

Species: The genus comprises three species: ***Dermatolepis inermis*** of the western Atlantic and Caribbean Sea, ***D. dermatolepis*** of the eastern Pacific, and ***D. striolata*** in the western Indian Ocean.

Remarks: *Dermatolepis* was regarded as a subgenus of *Epinephelus* by C.L. Smith (1971), Johnson (1983) and Johnson and Keener (1984). According to Smith-Vaniz et al. (1988), the scales of *Alphestes* and *Dermatolepis* are distinct from all other groupers. *Dermatolepis* differs from *Alphestes* in lacking the strong antrorse spine on the preopercle, in head shape (eye diameter about half of snout length, versus greater than or subequal to snout), and in having larvae with a smooth neurocranium (dorsal part of neurocranium extremely rugose in *Alphestes*). The interrelationships of the species of *Dermatolepis* are not apparent.

Dermatolepis dermatolepis (Boulenger, 1895)

Fig. 115; Pl. VID

SERRAN Dermat 3

Epinephelus dermatolepis Boulenger, 1895:256 (replacement name for ***Dermatolepis punctatus*** Gill, 1862, preoccupied in ***Epinephelus*** by ***Holocentrus punctatus*** Bloch, 1790; type locality of ***D. punctatus***: Cape San Lucas, Baja California).

Synonyms: ***Dermatolepis punctatus*** Gill, 1862a:54. ***Epinephelus dermatolepis***.

FAO Names: **En** - Leather bass; **Fr** - Mérou cuir; **Sp** - Mero coriaceo.

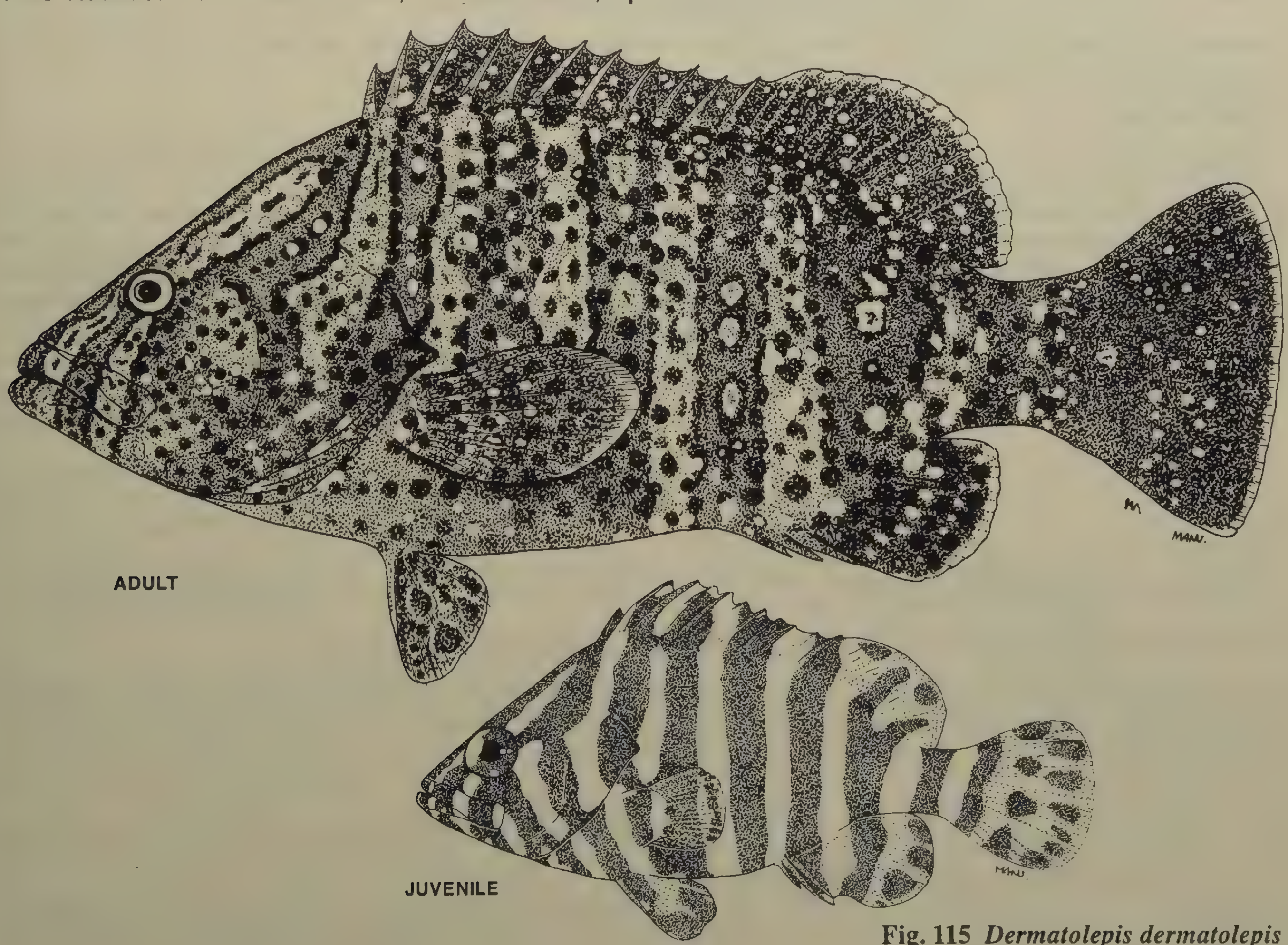


Fig. 115 ***Dermatolepis dermatolepis***
(adult, juvenile)

Diagnostic Features: Body depth usually greater than head length, depth contained 2.1 to 2.5 times in standard length (for fish 14 to 44 cm standard length). Eye diameter much less than snout length, eye diameter contained 5.2 to 8.0 times in head length. Gill rakers (total) 21 to 24. Dorsal fin with XI spines and 18 to 20 rays; anal fin with III spines and 9 rays; pectoral fins with 19 or 20 rays; pectoral fins short, their length 18 to 26% of standard length; caudal fin rounded. Scales smooth, mostly covered by skin; lateral-line scales 62 to 67; lateral-scale series difficult to count. **Colour:** Adults with ground colour grey or brownish, irregular white spots and blotches on the dark bars and small dark spots on the pale interspaces; large adults with yellow margin on the posterior parts of the median fins. Juveniles white with several black bars on body and extending into dorsal and anal fins; head with similar black bands; paired fins and distal parts of median fins with black spots.

Geographical Distribution: Eastern Pacific: Southern California to Ecuador, Revillagigedo and Galapagos Islands, Cocos Island, Clipperton Island (Fig. 116).

Habitat and Biology: Coral reefs and rocky bottoms in depths of 21 to at least 40 m. The leather bass is a diurnal predator that feeds on small benthic fishes and occasionally on crustaceans. It often uses browsing herbivorous fishes as a moving blind in order to feed on the cryptic fauna disturbed by these browsers, and it will also follow foraging moray eels to catch the fishes frightened from their hiding places in the reef when the eel enters crevices in search of prey. Small juveniles have been seen hiding among the long spines of the dark-coloured sea urchin, *Centrostephanus coronatus* (Verrill), for which their prominent dark-barred colour pattern is well suited.

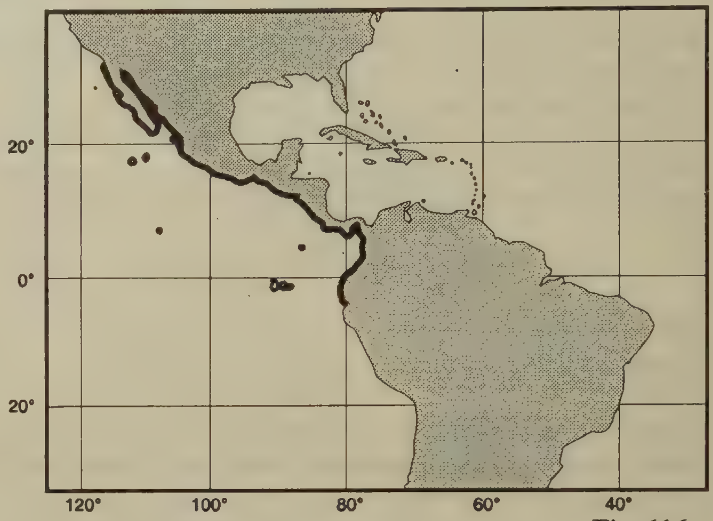


Fig. 116

Size: Attains a length of about 1 m total length (Thomson et al., 1979).

Interest to Fisheries: Probably of some local importance as a food fish, but *D. dermatolepis* is not abundant enough to be of commercial significance.

Local Names:

Literature: C.L. Smith (1971); Montgomery (1975); Thomson et al. (1979).

Remarks: This species differs from its Atlantic congener (*D. inermis*) in having shorter pectoral and pelvic fins (pectoral-fin length 18 to 26% of standard length, versus 29 to 35% of standard length; pelvic-fin length 13 to 20% of standard length, versus 20 to 23% of standard length) and in its colour pattern (juveniles with black bars and bands on a white background, versus juveniles black with white spots). The configuration of the median fins and the colour patterns of adults are also different in these two species.

Dermatolepis inermis (Valenciennes, 1833) Fig. 117; Pl. VIE SERRAN Dermat 1

Serranus inermis Valenciennes in Cuv. and Val., 1833:436 (type locality: Antilles).

Synonyms: *Dermatolepis zanclus* Evermann and Kendall, 1898:129, pl. 8, fig. 9 (type locality: Key West, Florida). *Dermatolepis marmoratus* Osburn and Mowbray, 1915:1 (type locality: Key West, Florida). *Epinephelus inermis*.

FAO Names: **En** - Marbled grouper; **Fr** - Mérou marbré; **Sp** - Mero marmol.

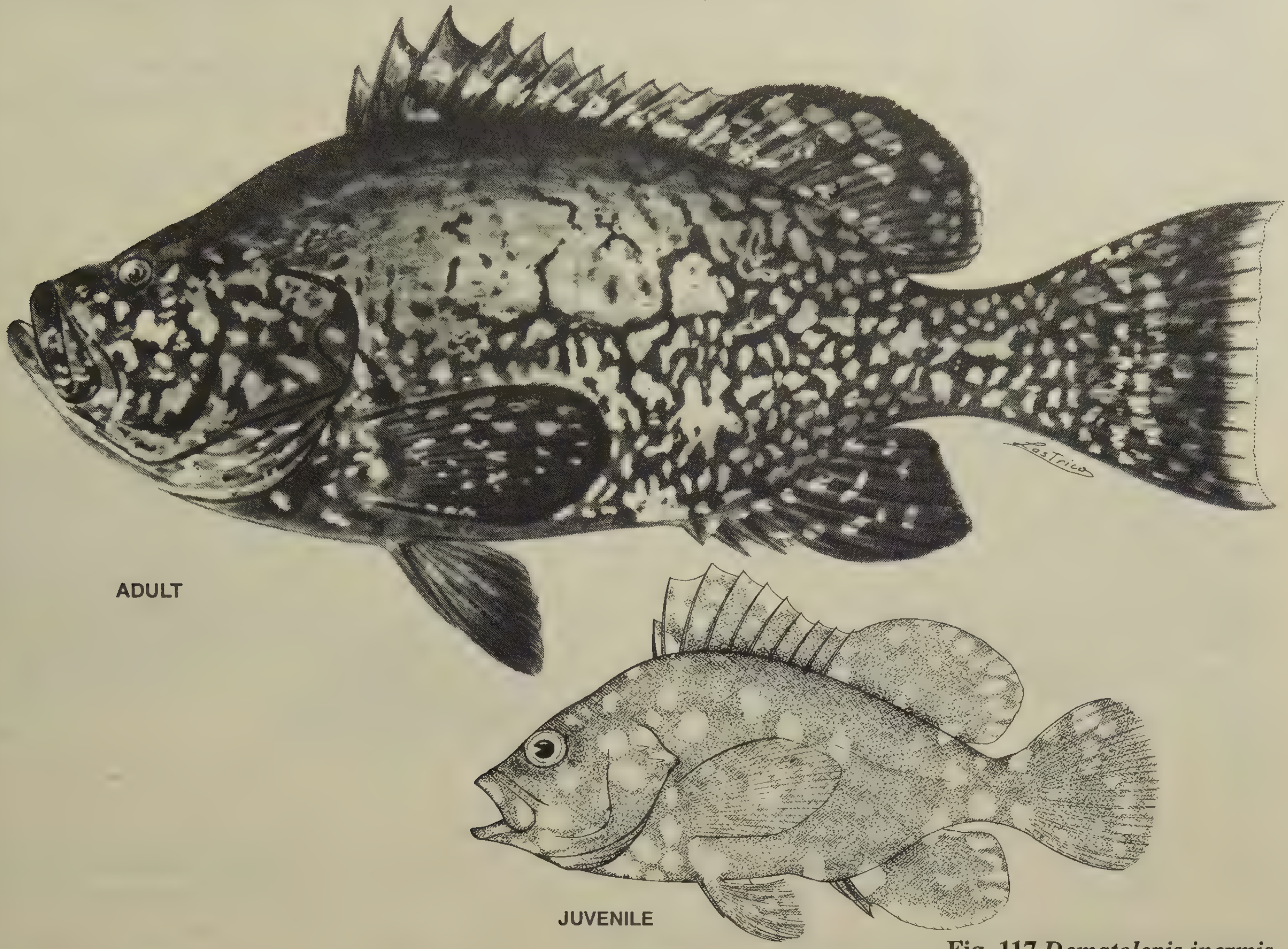


Fig. 117 ***Dematolepis inermis***
(adult, juvenile about 250 mm total length)

Diagnostic Features: Body deep and compressed, the greatest depth distinctly more than head length, contained 2.2 to 2.5 times in standard length (for fish 15 to 34 cm standard length); body width contained 2.2 to 2.9 in the depth. Head length contained 2.5 to 2.8 times in standard length; preopercle finely serrate, the serrae at angle slightly enlarged. Gill rakers 19 to 22 (total). Dorsal fin with XI spines and 18 to 20 rays, the membranes only slightly incised between the spines and the third or fourth spine longest; anal fin with III spines and 8 to 10 rays, the rear margin falcate in large adults; pectoral-fin length 29 to 35% of standard length, pectoral-fin rays 18 or 19; caudal fin rounded in juveniles, truncate or concave in adults. Scales smooth, deeply embedded. **Colour**: Adults mottled greyish brown with white speckles and small black spots that tend to be arranged in rings; juveniles black or dark brown covered with irregular white spots and blotches.

Geographical Distribution: Western Atlantic from North Carolina to Rio de Janeiro, including the Gulf of Mexico and Caribbean (Fig. 118).

Habitat and Biology: A rare, secretive species; virtually nothing is known of the biology. Depth records range from 21 to 213 m.

Size: Maximum total length about 90 cm; maximum weight over 10 kg.

Interest to Fisheries: Because of its rarity, ***D. inermis*** is of little commercial importance.

Local Names: CUBA: Cherna jaspeada; VENEZUELA: Mero tigre, Viuda.

Literature: Cervigón (1966); Smith (1971); Johnson and Keener (1984); Dennis and Bright (1988).

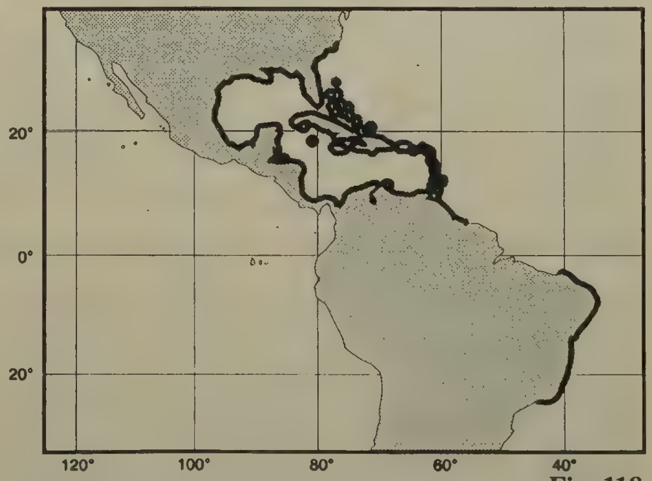


Fig. 118

Dermatolepis striolata (Playfair, 1867)

Fig. 119; Pl. VIF

SERRAN Dermat 2

Serranus striolatus Playfair in Playfair and Günther, 1867:11, pl. 3, fig. 2 (type locality: Zanzibar).

Synonyms: *Serranus gibbosus* Boulenger, 1887:654 (type locality: Muscat, Oman). ***Dermatolepis aldabrensis*** Smith, 1955:311, pl. 3, fig. B (type locality: Aldabra).

FAO Names: **En** - Smooth grouper; **Fr** - Mérou lisse; **Sp** - Mero liso.

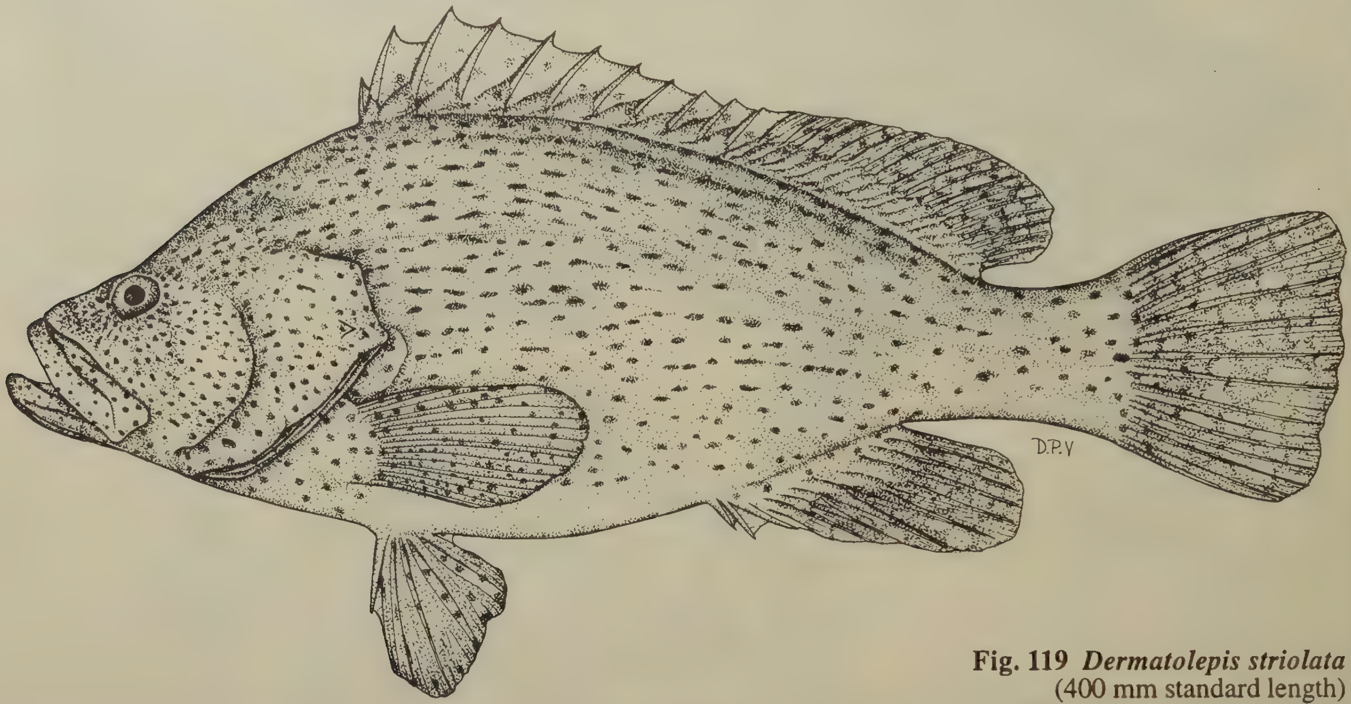


Fig. 119 ***Dermatolepis striolata***
(400 mm standard length)

Diagnostic Features: Body depth greater than head length, depth contained 2.4 to 2.6 times in standard length (for fish 27 to 40 cm standard length). Eye diameter much less than snout length, contained 7.2 to 8.1 times in head length; preopercle serrate, but the serrae are covered by skin; opercular spines not apparent. Gill rakers 5 to 7 on upper limb and 13 to 16 on lower limb, total 18 to 22. Dorsal fin with XI spines and 18 or 19 rays, the fin origin over the opercle and the membranes not incised between the spines; anal fin with III spines and 9 or 10 rays; pectoral fins with 17 to 19 rays, pectoral-fin length 23 to 27% of standard length; caudal fin rounded or truncate with rounded corners. Scales smooth and mostly covered by skin; lateral-line scales 69 to 71; lateral-scale series difficult to count, 118 to 124. **Colour**: Yellowish to reddish brown, paler ventrally; adults with small, round, dark spots all over head, body and fins; juveniles with numerous small dark brown spots on head, body (where they are often horizontally elongate, even forming short lines) and fins (where they are less distinct); median fins also with pale spots; head and body also with more or less distinct, irregular, pale blotches of various sizes.

Geographical Distribution: Western Indian Ocean: Gulf of Oman and south coast of Arabian Peninsula, Aldabra, Comoros, Madagascar, and coast of Africa from Kenya to South Africa (Durban) (Fig. 120).

Habitat and Biology: It is a rare species seen on shallow coral reefs to depths of 15 m. Morgans (1982) reports shoaling behaviour in small groups (8 or fewer individuals). The stomach contents of 5 specimens were examined by Morgans; 3 were empty and 2 contained fish remains.

Size: Attains at least 85 cm total length and 10.5 kg.

Interest to Fisheries: Too rare to be of commercial importance.

Local Names: MADAGASCAR: Alovo.

Literature: Heemstra and Randall (1984, 1986); Randall and Heemstra (1991); see also references above.

Remarks: *D. striolata* differs from *D. inermis* in its shorter pectoral fins (29 to 35% of standard length for *D. inermis*) and its colour pattern. ***D. dermatolepis*** differs in having fewer lateral-line scales (62 to 67) and in colour pattern.

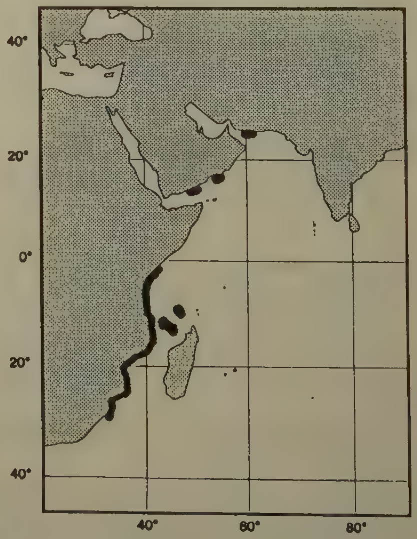


Fig. 120

Epinephelus Bloch, 1793

SERRAN Epin

Epinephelus Bloch, 1793:11; type species, ***Epinephelus marginalis*** Bloch, 1793 (= ***Epinephelus fasciatus***), designated under the plenary powers of the International Commission on Zoological Nomenclature, Opinion 93.

Synonyms: ***Merou*** Bonaparte, 1831:167; type species, ***Perca gigas*** Brünnich by subsequent designation of Jordan, 1919:175. ***Cerna*** Bonaparte, 1833:puntàta 10; type species, ***Perca gigas*** Brünnich by monotypy. ***Cynichthys*** Swainson, 1839:168, 201; type species, ***C. flavo-purpuratus*** (=***Perca flava-purpurea*** Bennett =***Epinephelus flavocaeruleus***). ***Cernua*** Costa, 1849:1 (not available; unjustified emendation of ***Cerna*** Bonaparte; preoccupied by ***Cernua*** Fleming, 1828:212 (a genus of percid fish). ***Hyporthodus*** Gill, 1862b:98; type species, ***Hyporthodus flavicauda*** Gill (=***Epinephelus niveatus***) by monotypy. ***Schistorus*** Gill, 1862c:236; type species, ***Serranus mystacinus*** Poey, by monotypy. ***Labroperca*** Gill, 1862c:236; type species, ***Serranus labriformis*** Jenyns, by monotypy. ***Promicrops*** Poey, 1868:287; type species, ***Serranus guasa*** Poey (=***Epinephelus itajara***) by monotypy; genus attributed to Gill by Poey, but the diagnosis is Poey's. ***Priacanthichthys*** Day, 1868:193; type species, ***Priacanthichthys maderaspatensis*** Day (=***Epinephelus latifasciatus***) by monotypy. ***Merus*** Poey, 1874:39; type species, ***Epinephelus marginalis*** Bloch (=***Epinephelus fasciatus***); proposed as a replacement name for ***Epinephelus*** Bloch. ***Homalogrystes*** Alleyne and Macleay, 1877:268; type species, ***Homalogrystes Guntheri*** Alleyne and Macleay (=***Epinephelus coioides***) by monotypy. ***Itaiara*** Vaillant and Bocourt, 1878:70; type species, ***Serranus itajara*** Lichtenstein, by monotypy. ***Hyposerranus*** Klunzinger, 1884:3; type species, ***Serranus morrhua*** Valenciennes, by subsequent designation of Jordan, 1920; proposed as a subgenus of ***Serranus***. ***Phrynotitan*** Gill, 1885:225; type species, ***Batrachus gigas*** Günther, (=***Epinephelus lanceolatus***) by monotypy. ***Garrupa*** Jordan in Jordan and Eigenmann, 1890:350, 353; type species, ***Serranus nigritus*** Holbrook, by original designation; proposed as a subgenus of ***Epinephelus***. ***Enneistus*** Jordan and Evermann, 1896:1147; type species, ***Bodianus acanthistius*** Gilbert, by monotypy; proposed as a subgenus of ***Bodianus***. ***Stereolepoides*** Fowler, 1923:382; type species, ***Stereolepoides thompsoni*** Fowler (=***Epinephelus lanceolatus***). ***Vivero*** Jordan and Evermann, 1927:505; type species, ***Serranus morio*** Valenciennes, by monotypy; proposed as a subgenus of ***Epinephelus***. ***Serrihastaperca*** Fowler, 1944:384; type species, ***Serrihastaperca exsul*** Fowler, by original designation. ***Altiserranus*** Whitley, 1947:50; type species, ***Serranus jayakari*** Boulenger, 1889 (=***Epinephelus multinotatus***) by original designation.

Diagnostic Features: Body elongate, robust (subcylindrical), oblong or deep and compressed; body depth greater than, subequal to or less than head length and contained 2.3 to 3.7 times in standard length, the body width 1.8 to 2.8 in the depth. Head length 2.1 to 2.8 times in standard length; preorbital depth 6.7 to 15 times in head length; preopercle rounded or angular, the posterior edge serrate, with the serrae at the angle more or less enlarged; a few species with small serrae (mostly covered by skin) on the ventral edge; canines present at front of jaws, but they may be small in some species; no distinctly enlarged canine teeth at midside of lower jaw; teeth present on palatines; maxilla of adults without a distinct bony knob on ventroposterior corner, but there may be an abrupt step or hook-like process (covered by the upper lip) on the distal part of the ventral edge; supramaxilla well developed. Dorsal fin usually with XI spines (X spines in ***E. analogus***, ***E. exsul***, and ***E. nigritus***, IX in ***E. acanthistius***) and 12 to 19 rays, the fin origin above the opercle; length of base of soft-rayed part of dorsal fin not more than base of spinous part; anal fin with III distinct spines and 7 to 10 (very rarely 7 or 10) rays; pectoral fin rounded, the middle rays longest; caudal fin rounded, truncate or concave, with 8 branched rays and 8 to 10 procurrent rays in upper part and 7 branched rays and 7 to 10 procurrent rays in lower part. Scales on body ctenoid or smooth. Supraneural bones 2; dorsal and anal fins without trisegmental pterygiophores; rear edge of first dorsal pterygiophore with or without excavation for tip of second neural spine; epipleural ribs on vertebrae 1 to 10 (except ***E. stictus*** with epipleurals on only the first 8 vertebrae). The diversity of cranial morphology of the many species assigned to ***Epinephelus*** makes it difficult to recognize diagnostic cranial characters for the genus. Characters of the larvae (Leis, 1986): pelvic-fin spines with 4 ridges; supraocular ridge with a single strong spine; spines on lower limb of preopercle serrate; posterior 1 or 2 dorsal-fin spines develop first as soft rays and all spines are present in larvae of 13.5 to 16.0 mm; all anal-fin spines are present prior to settlement at a length of 16 to 18 mm standard length.

Habitat and Biology: ***Epinephelus*** species are generally found on coral or rocky reefs, but a few species (e.g., ***E. aeneus***, ***E. bruneus***, and ***E. areolatus***) are commonly taken with trawls over sandy, silty or mud bottoms. Some species occur in deep water (to at least 525 m), but most are found in depths of 10 to 200 m. The two largest species (***E. itajara*** and ***E. lanceolatus***, which grow to well over 2 metres in length and a weight of over 400 kg) are often found in estuaries and harbours. Most species of ***Epinephelus*** are epibenthic predators feeding on macro invertebrates (mainly crustaceans) and fishes on or near the bottom. ***E. undulosus***, an unusual grouper with long numerous gill rakers, occasionally feeds on pelagic tunicates. The reproduction of a few species has been studied, and they appear to be protogynous hermaphrodites; but the picture is complicated in some species by the occurrence of males that are much smaller than some females. It may be that not all females change sex, and perhaps some males do not go through a previous female stage.

Geographical Distribution: The genus is represented in tropical and subtropical latitudes of all oceans. Most species are found in the vast Indo-West Pacific region. Eight species occur in the eastern Pacific, eleven species are known from the western Atlantic, and 9 species are found in the eastern Atlantic and Mediterranean. Of the two species that occur in both the eastern Pacific and western Atlantic oceans (*E. itajara* and *E. mystacinus*), only *E. itajara*, with its preference for shallow estuarine conditions, is likely to cross the Central American isthmus via the Panama Canal. Although we did not find any significant morphological differences in specimens of *E. mystacinus* from the two oceans, it would not surprise us if there are significant differences in biochemical features (enzymes, mitochondrial DNA, etc.) of specimens from these two oceans.

Interest to Fisheries: The species of *Epinephelus* are among the most important commercial fishes in tropical fisheries of the world. They are among the highest priced species in fish markets, and a few species (e.g., *E. coioides* and *E. malabaricus*) are used in aquaculture ventures.

Species: The genus *Epinephelus*, as here defined, comprises some 98 species and is thus the most species genus of serranid fishes. It is well represented in the tropical and subtropical waters of all three major oceans.

Remarks: C.L. Smith (1971) demoted the genus *Promicrops* (comprising *E. itajara* and *E. lanceolatus*) to a subgenus of *Epinephelus*. We agree with this decision and his statement that these two species "are highly specialized and distinctive although their alliance with other species of *Epinephelus* is clear." We also agree with Smith's (1971) assignment of the eastern Pacific species *Bodianus acanthistius* Gilbert to the genus *Epinephelus*, rather than to *Cephalopholis*, even though this species has only IX dorsal-fin spines. (See the species account below for further discussion of the affinities of *E. acanthistius*.) We disagree with Smith's (1971) decision to include the genera *Alphestes*, *Cephalopholis*, and *Dermatolepis* in *Epinephelus*, because it appears that *Epinephelus* (as here recognized) may be more closely related to the genus *Mycteroperca*. The species of both genera have the base of the soft-rayed part of the dorsal fin shorter than or equal to the base of the spinous part, they have only bisegmental pterygiophores supporting the dorsal and anal fins (some trisegmental pterygiophores are present in *Cephalopholis*), and (according to Smith-Vaniz et al., 1988) the scales of *Alphestes* and *Dermatolepis* are different from all other groupers.

Key to Western Atlantic Species of *Epinephelus*

1a. Dorsal-fin rays 14 to 18; anal-fin rays 8 to 10; pelvic-fin origin below or behind lower end of pectoral-fin base (Fig. 121); pelvic fins not longer than pectoral fins (usually less than 90% of pectoral-fin length); red spots present or absent on head and body . . . . → *2*

1b. Dorsal-fin rays 13 to 15; anal-fin rays 9; pelvic-fin origin in front of lower end of pectoral-fin base; pelvic fins (of fish 10 to 50 cm standard length) subequal to or longer than pectoral fins (Fig. 122); head and body not covered with dark red spots . . . . → *8*

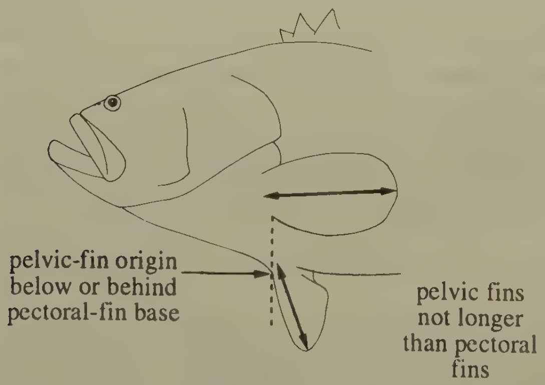

pelvic-fin origin below or behind pectoral-fin base
pelvic fins not longer than pectoral fins

Fig. 121

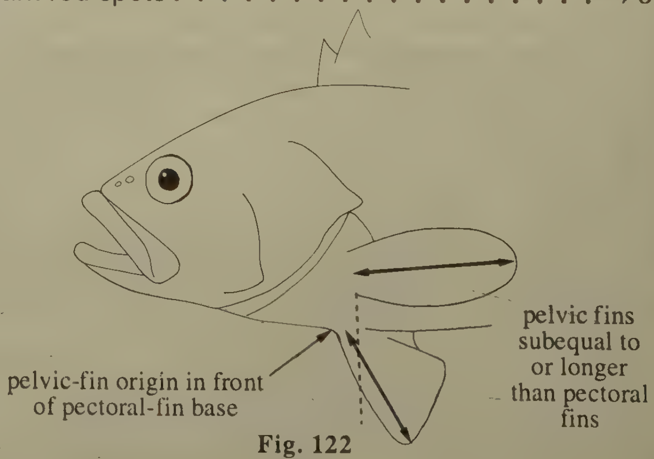

pelvic-fin origin in front of pectoral-fin base
pelvic fins subequal to or longer than pectoral fins

Fig. 122

2a. Anal-fin rays 8 to 10; rear margin of caudal fin truncate or concave . . . . → *3*

2b. Anal-fin rays 8; caudal fin convex or rounded. . . . . → *4*

3a. Dorsal-fin membranes distinctly notched between the spines, the third or fourth spine longest; head, body and median fins covered with small white spots (Fig. 123, Plate XIII) (southern coast of USA, Bermuda) . . . . *E. drummondhayi*

3b. Dorsal-fin membranes not notched between the spines, the second spine longest; head and body dark reddish brown, usually with irregular pale spots and blotches; black dots on snout and cheek (Fig. 124, Plate XIX) (Caribbean, Gulf of Mexico, Bermuda, southern Brazil) . . . *E. morio*

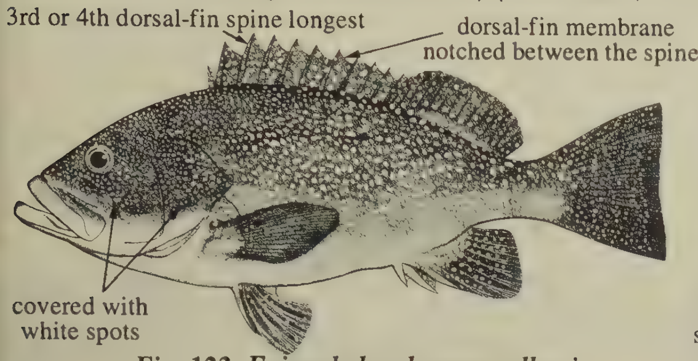

3rd or 4th dorsal-fin spine longest
dorsal-fin membrane notched between the spines
covered with white spots

Fig. 123 ***Epinephelus drummondhayi***

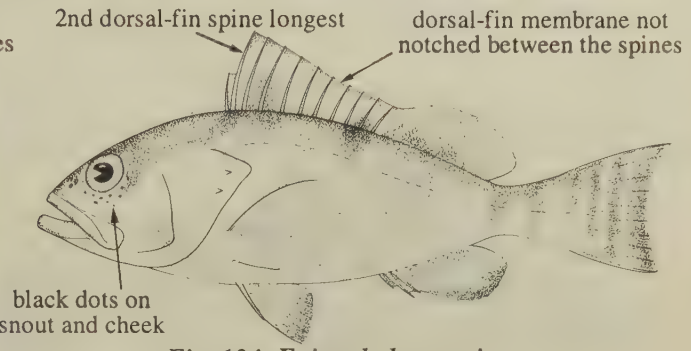

2nd dorsal-fin spine longest
dorsal-fin membrane not notched between the spines
black dots on snout and cheek

Fig. 124 ***Epinephelus morio***

4a. Third to 11th dorsal-fin spines subequal and distinctly shorter than dorsal-fin rays; greatest body width equals half or more of body depth (Fig. 125, Plate XVI) (from Florida to southern Brazil, including Gulf of Mexico and Caribbean) . . . . *E. itajara*

4b. Third or fourth dorsal-fin spine longest, longer than anterior dorsal-fin rays; body width distinctly less than half the depth . . . . → *5*

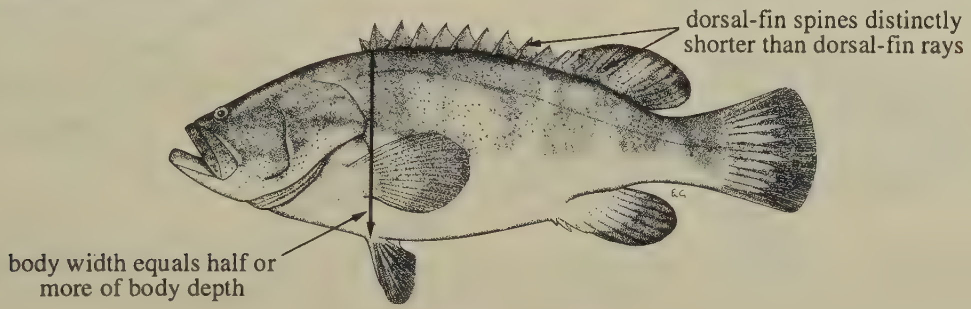

dorsal-fin spines distinctly shorter than dorsal-fin rays
E.C.
body width equals half or more of body depth

Fig. 125 ***Epinephelus itajara***

5a. Head and body covered with dark orange-brown or dark red spots. . . . . → *6*

5b. No dark orange-brown or dark red spots . . . . → *7*

6a. Black saddle blotch on peduncle and 3 to 5 dark blotches at base of dorsal fin; no blackish margin on soft-rayed part of dorsal fin; pectoral-fin rays 18 to 20 (Fig. 126, Plate VII) (from Massachusetts to southern Brazil, including Gulf of Mexico and Caribbean) . . . . . *E. adscensionis*

6b. No black saddle on peduncle; no dark blotches at base of dorsal fin; soft dorsal fin with blackish margin; pectoral-fin rays 16 to 18 (Fig. 127, Plate XV) (from North Carolina to Venezuela, including Gulf of Mexico and Caribbean). . . . . *E. guttatus*

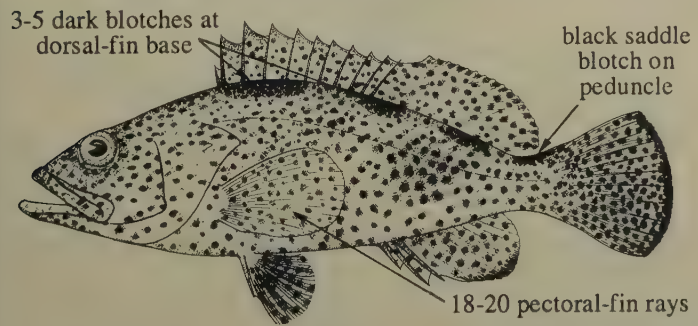

3-5 dark blotches at dorsal-fin base
black saddle blotch on peduncle
18-20 pectoral-fin rays

Fig. 126 ***Epinephelus adscensionis***

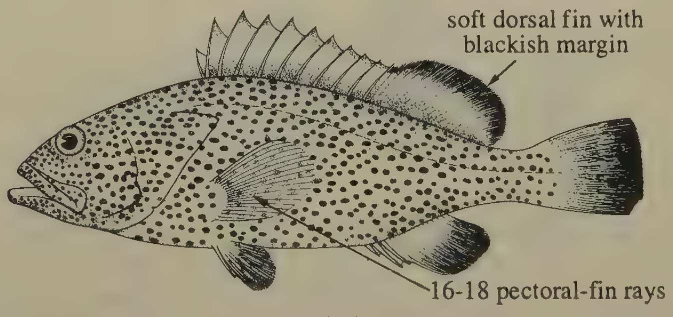

soft dorsal fin with blackish margin
16-18 pectoral-fin rays

Fig. 127 ***Epinephelus guttatus***

7a. Head and body pale, with irregular dark bars or bands (but colour can change from almost white to uniform dark brown in a few minutes); black saddle blotch on peduncle; black dots below and behind eye; dark tuning-fork mark between the eyes; lateral-line scales about 50 (Fig. 128, Plate XXIII) (Bahamas, Bermuda, Caribbean, southern Brazil) . . . . *E. striatus*

7b. Head and body brownish, usually with irregular pale spots or blotches; no dark saddle on peduncle or dark marks on top of head; lateral-line scales 62 to 73 (Fig. 129, Plate XVII) (southern Brazil) . . . . *E. marginatus*

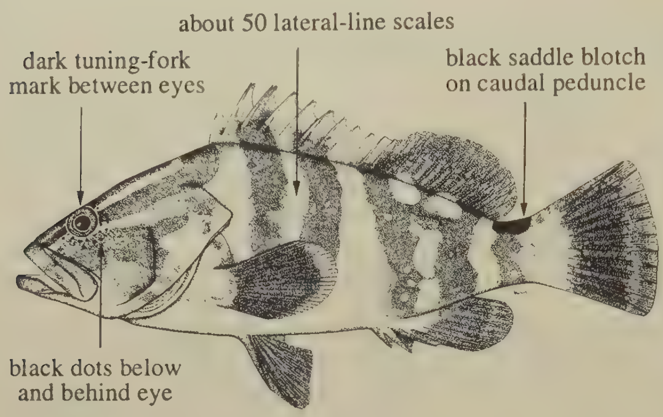

about 50 lateral-line scales
dark tuning-fork mark between eyes
black saddle blotch on caudal peduncle
black dots below and behind eye

Fig. 128 *Epinephelus striatus*

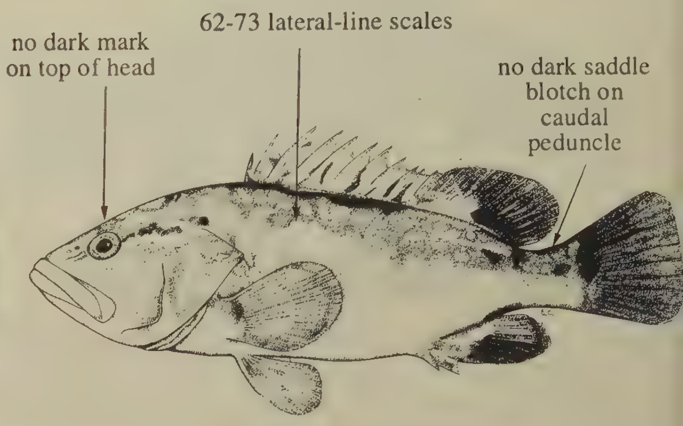

no dark mark on top of head
62-73 lateral-line scales
no dark saddle blotch on caudal peduncle

Fig. 129 *Epinephelus marginatus*

8a. Dorsal-fin spines X, the second spine longest; no dark bar or saddle blotch on caudal peduncle (Fig. 130, Plate XIX) (southern coast of USA, Cuba, Trinidad, Rio de Janeiro) . *E. nigritus*

8b. Dorsal-fin spines XI, the second, third or fourth spine longest; juveniles (less than 20 cm standard length) with a black bar or saddle blotch on caudal peduncle . . . . → *9*

9a. Body brownish, with 8 or 9 subvertical dark bars (last 2 may be fused into a wide band on caudal peduncle) (Fig. 131, Plate XIX) (Gulf of Mexico, West Indies) . . . . *E. mystacinus*

9b. No dark vertical bars on body. . . . . → *10*

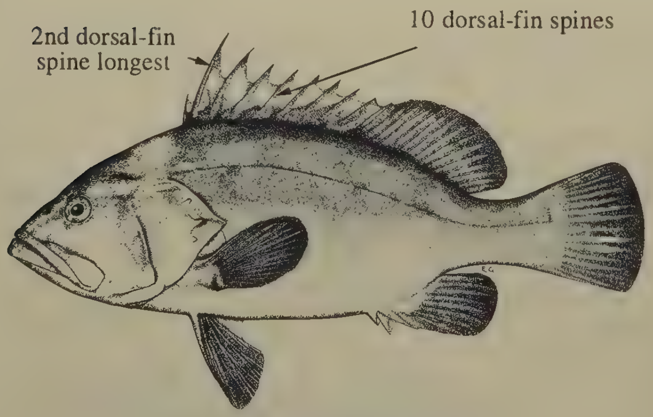

2nd dorsal-fin spine longest
10 dorsal-fin spines

Fig. 130 *Epinephelus nigritus*

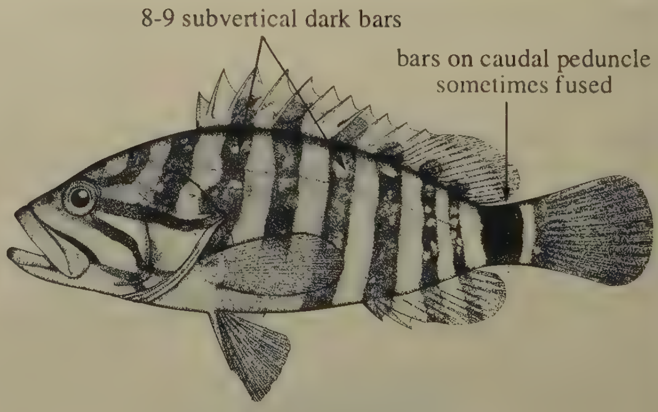

8-9 subvertical dark bars
bars on caudal peduncle sometimes fused

Fig. 131 *Epinephelus mystacinus*

10a. Posterior nostrils 3 to 5 times larger than anterior nostrils (except in fish less than 15 cm standard length); interspinous dorsal-fin membranes deeply incised, their margin black; no blue line from eye to preopercle; black saddle on caudal peduncle of juveniles reaches below lateral line (Fig. 132, Plate XX) (Massachusetts to southern Brazil, Gulf of Mexico, Caribbean, Bermuda). . . . . *E. niveatus*

10b. Nostrils subequal; interspinous dorsal-fin membranes not deeply incised, their margin yellow or yellowish green in juveniles and small adults; a pearly blue line from eye to corner of preopercle; black saddle on caudal peduncle not reaching below lateral line (Fig. 133, Plate XIV) (North Carolina to southern Brazil, Gulf of Mexico, Caribbean) . . . . . *E. flavolimbatus*

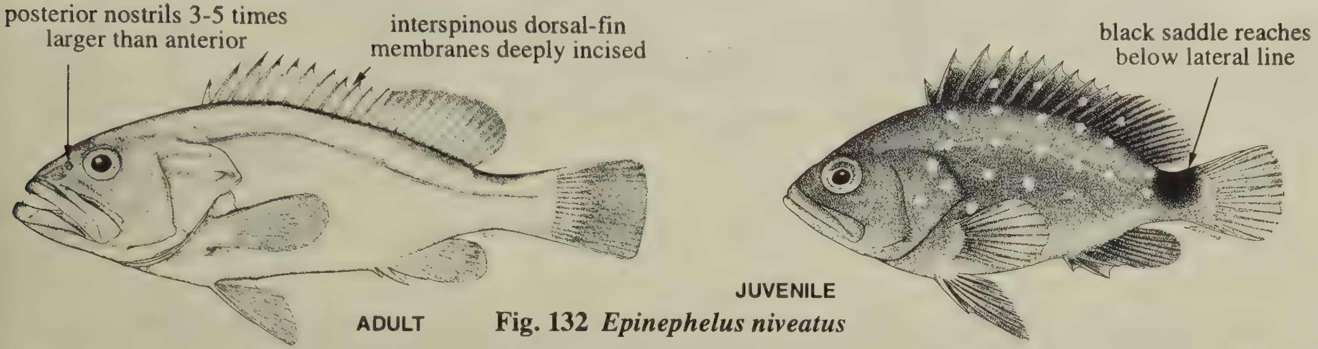

posterior nostrils 3-5 times larger than anterior
interspinous dorsal-fin membranes deeply incised
black saddle reaches below lateral line
ADULT
JUVENILE

Fig. 132 *Epinephelus niveatus*

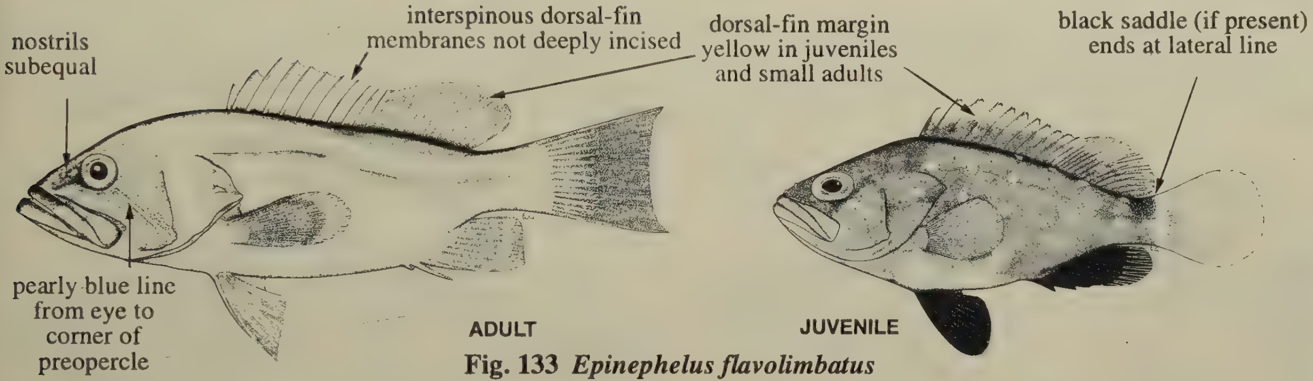

nostrils subequal
interspinous dorsal-fin membranes not deeply incised
dorsal-fin margin yellow in juveniles and small adults
black saddle (if present) ends at lateral line
pearly blue line from eye to corner of preopercle
ADULT
JUVENILE

Fig. 133 *Epinephelus flavolimbatus*

Key to Eastern Atlantic and Mediterranean Species of *Epinephelus*

1a. Dorsal-fin rays 15 to 17; caudal fin truncate to concave (convex in specimen less than 15 cm standard length); body depth 2.8 to 3.4 times in standard length; no dark spots or dark bars on body; juveniles with 3 to 5 dark longitudinal stripes on dorsal part of body (Fig. 134, Plate XI) (eastern Atlantic and Mediterranean) . . . . *E. costae*

1b. Dorsal-fin rays 13 to 18; body without dark stripes . . . . →2

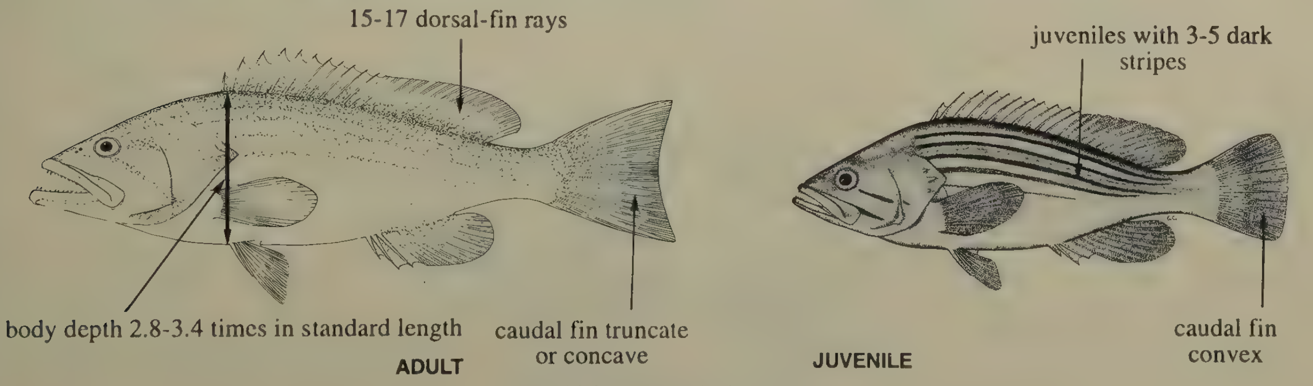

15-17 dorsal-fin rays
juveniles with 3-5 dark stripes
body depth 2.8-3.4 times in standard length
caudal fin truncate or concave
ADULT
JUVENILE
caudal fin convex

Fig. 134 *Epinephelus costae*

2a. Dorsal-fin rays 13 or 14; anal-fin rays 8; caudal fin truncate; body dark reddish brown to greyish violet; juveniles with 2 oblique dark lines running down and backwards from eye (Fig. 135) (eastern Atlantic and Mediterranean). . . . . *E. caninus*

2b. Dorsal-fin rays 14 to 18; anal-fin rays 7 to 9; caudal fin rounded, convex or truncate. . . . . . . → *3*

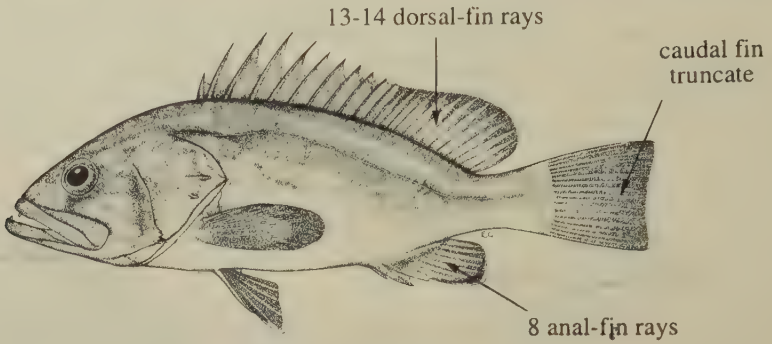

13-14 dorsal-fin rays
caudal fin truncate
8 anal-fin rays

Fig. 135 ***Epinephelus caninus***

3a. Body depth 2.8 to 3.6 times in standard length; head and/or body with dark spots (may be faint or absent in fish more than 40 cm standard length) (Fig. 136) . . . . → *4*

3b. Body depth 2.4 to 3.2 times in standard length; no dark spots on head or body (Fig. 137). . . . → *7*

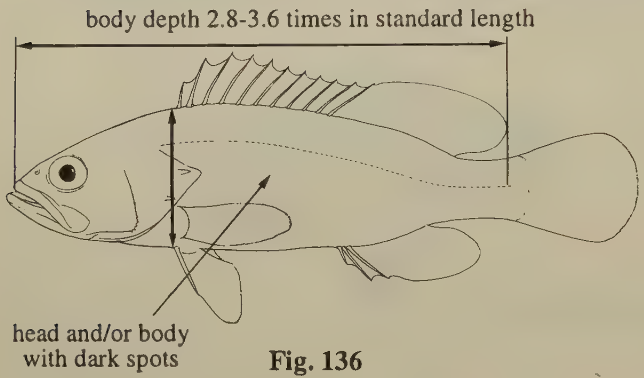

body depth 2.8-3.6 times in standard length
head and/or body with dark spots

Fig. 136

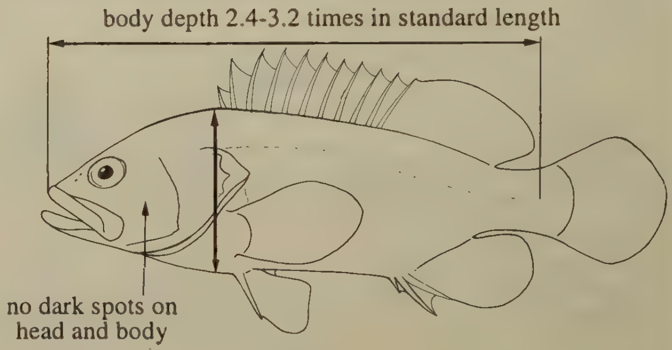

body depth 2.4-3.2 times in standard length
no dark spots on head and body

Fig. 137

4a. Head, body, and median fins covered with dark reddish brown or orange spots; third or fourth dorsal-fin spine longer than last spine or first dorsal-fin ray (Fig. 138) . . . . → *5*

4b. Dark spots on body are either indistinct or confined to anterior part of body; no small dark spots on median fins; 3rd to 11th dorsal-fin spines subequal and not longer than first dorsal-fin ray (Fig. 139) . . . → *6*

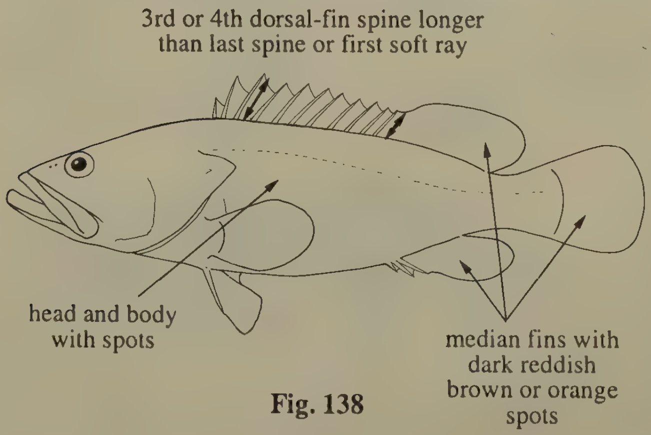

3rd or 4th dorsal-fin spine longer than last spine or first soft ray
head and body with spots
median fins with dark reddish brown or orange spots

Fig. 138

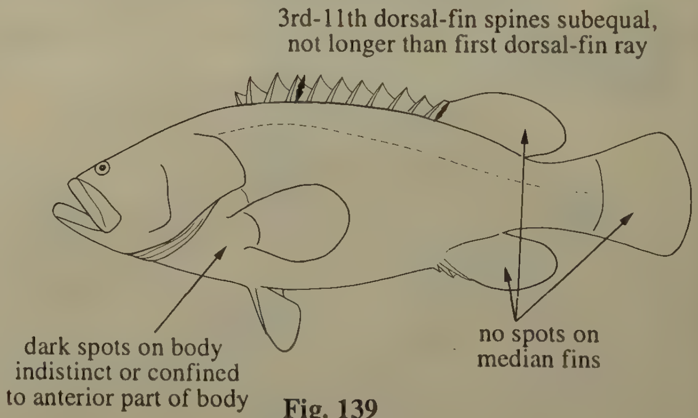

3rd-11th dorsal-fin spines subequal, not longer than first dorsal-fin ray
dark spots on body indistinct or confined to anterior part of body
no spots on median fins

Fig. 139

5a. Dorsal-fin rays 16 to 18; dark brown saddle blotch on caudal peduncle; spots on head and body reddish brown; 16 to 19 gill rakers on lower limb (Fig. 140, Plate VII) (Ascension and St. Helena Islands, São Tomé). . . . . *E. adscensionis*

5b. Dorsal-fin rays 14 to 16; no dark saddle blotch on peduncle; spots on head and body brownish orange in life; lower gill rakers 14 to 17 (Fig. 141, Plate X) (Israel) . . . . *E. coioides*

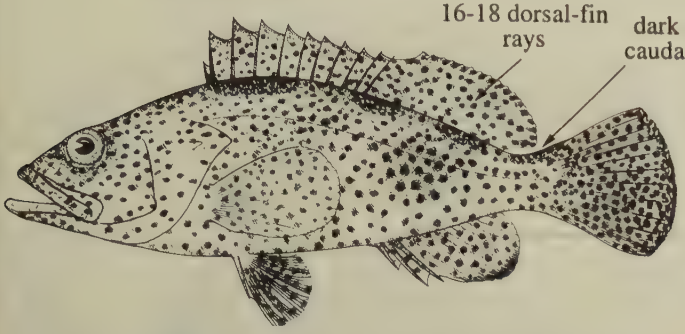

16-18 dorsal-fin rays
dark blotch on caudal peduncle

Fig. 140 ***Epinephelus adscensionis***

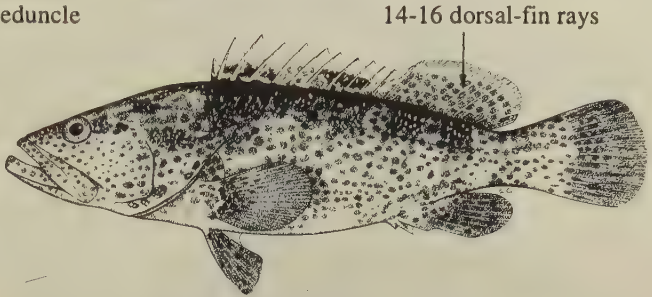

14-16 dorsal-fin rays

Fig. 141 ***Epinephelus coioides***

6a. Two oblique black-edged pale blue or white stripes across cheek and operculum; no dark spots on head; lower gill rakers 15 to 17; interorbital width subequal to eye diameter on fish of 18 to 25 cm standard length; preopercle with 3 to 6 large spines at the angle (Fig. 142, Plate VII) (southern Mediterranean and west coast of Africa) . . . . *E. aeneus*

6b. Head with dark spots (in juveniles) but no blue stripes; lower gill rakers 13 to 15; interorbital width distinctly greater than eye on fish of 18 to 25 cm standard length; preopercle rounded, finely serrate (Fig. 143, Plate XVI) (tropical western Africa). . . . . *E. itajara*

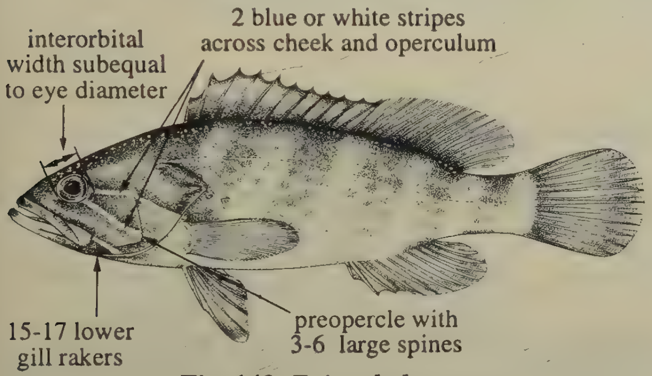

interorbital width subequal to eye diameter
2 blue or white stripes across cheek and operculum
15-17 lower gill rakers
preopercle with 3-6 large spines

Fig. 142 ***Epinephelus aeneus***

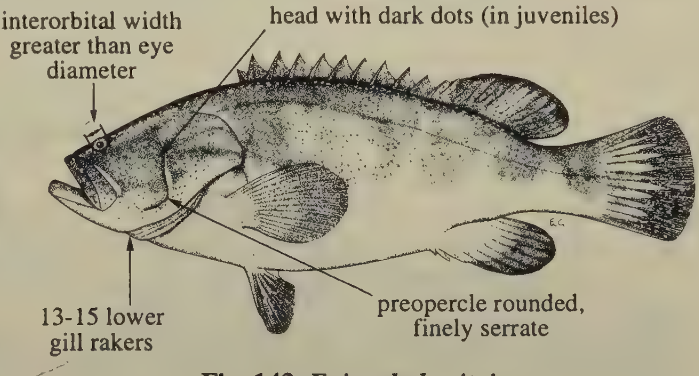

interorbital width greater than eye diameter
head with dark dots (in juveniles)
13-15 lower gill rakers
preopercle rounded, finely serrate

Fig. 143 ***Epinephelus itajara***

7a. Anal-fin rays 9; pectoral-fin rays 19 to 21; body depth 2.4 to 2.7 times in standard length; pelvic-fin length subequal to pectoral-fin length, pelvic fins reaching to or beyond anus in fish of 13 to 30 cm standard length (Fig. 144, Plate XV) (eastern Mediterranean to southern Angola). . . . . *E. haifensis*

7b. Anal-fin rays 8; pectoral-fin rays 17 to 19; body depth 2.6 to 3.2 times in standard length; pelvic-fin length distinctly shorter than pectoral-fin length, pelvic fins falling well short of anus. . . . . → *8*

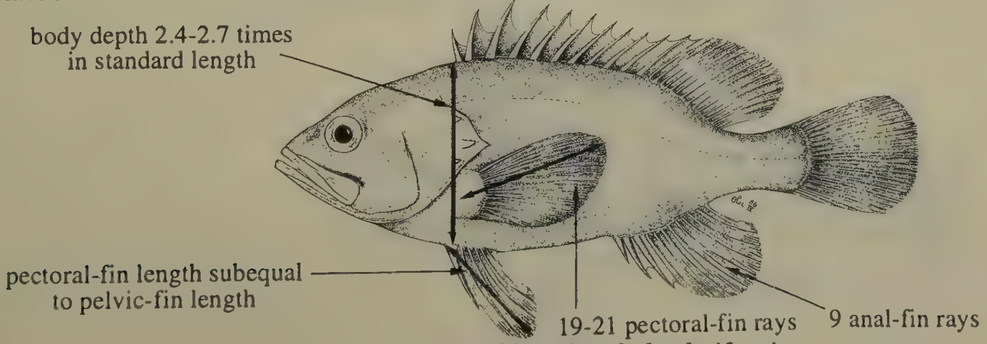

body depth 2.4-2.7 times in standard length
pectoral-fin length subequal to pelvic-fin length
19-21 pectoral-fin rays
9 anal-fin rays

Fig. 144 ***Epinephelus haifensis***

8a. Colour generally brownish; juveniles with 3 or 4 broad, oblique dark bars on dorsal part of body and another on dorsal half of peduncle; caudal fin truncate (slightly convex in small juveniles); ventral edge of subopercle and interopercle serrate; lateral-scale series 120 to 129 (Fig. 145, Plate XV) (tropical coast of western Africa) . . . . ***E. goreensis***

8b. Body dark brown or greyish dorsally, often golden yellow ventrally; irregular white or pale grey blotches usually visible on head and body; median fins dark brown, the lower margin of anal fin and rear margin of caudal fin with a narrow white edge; margin of spinous dorsal fin and base of paired fins often golden yellow; caudal fin rounded (truncate with rounded corners in some fish larger than 40 cm standard length); subopercle and interopercle smooth; lateral-scale series 102 to 116 (Fig. 146, Plate XVIII) (Mediterranean and eastern Atlantic from Great Britain around southern tip of Africa). . . . . ***E. marginatus***

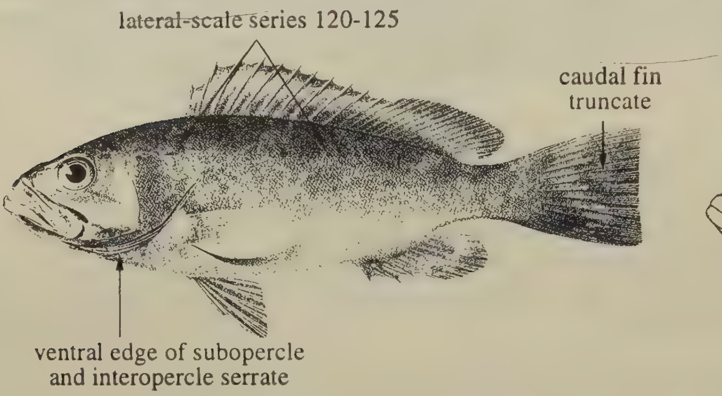

lateral-scale series 120-125
caudal fin truncate
ventral edge of subopercle and interopercle serrate

Fig. 145 *Epinephelus goreensis*

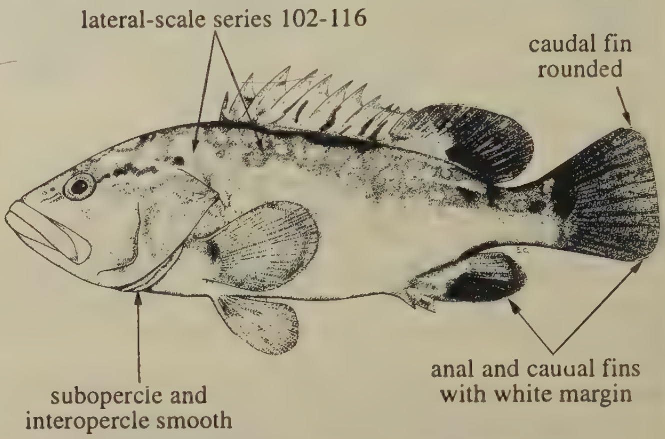

lateral-scale series 102-116
caudal fin rounded
subopercle and interopercle smooth
anal and caudal fins with white margin

Fig. 146 *Epinephelus marginatus*

Key to Eastern Pacific Species of *Epinephelus*

1a. Dorsal fin with IX spines and 17 rays; adults with the second to fourth dorsal-fin spines greatly elongate (Fig. 147, Plate VII) (southern California to Peru) . . . . ***E. acanthistius***

1b. Dorsal fin with X or XI spines and 13 to 18 rays; second to forth dorsal-fin spine not elongate (except in ***E. cifuentesi*** and possibly ***E. exsul***) . . . . → *2*

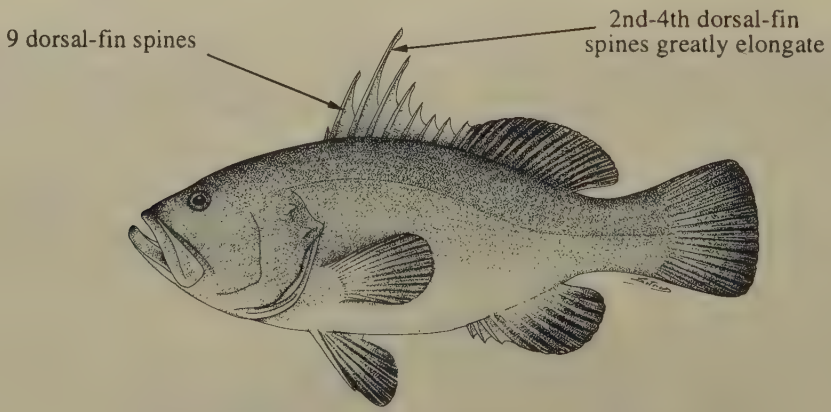

9 dorsal-fin spines
2nd-4th dorsal-fin spines greatly elongate

Fig. 147 *Epinephelus acanthistius*

2a. Dorsal-fin spines X; anal-fin rays 8 . . . . →*3*

2b. Dorsal-fin spines XI; anal-fin rays 8 or 9. . . . . →*4*

3a. Dorsal-fin rays 16 to 18; body pale, with dark spots (Fig. 148, Plate VIII) (southern California to Peru, Galapagos Islands) . . . . *E. analogus*

3b. Dorsal-fin rays 13 or 14; body dark brown with faint pale spots (colour pattern of adults unknown) (Fig. 149) (Gulf of California to Panama) . . . . *E. exsul*

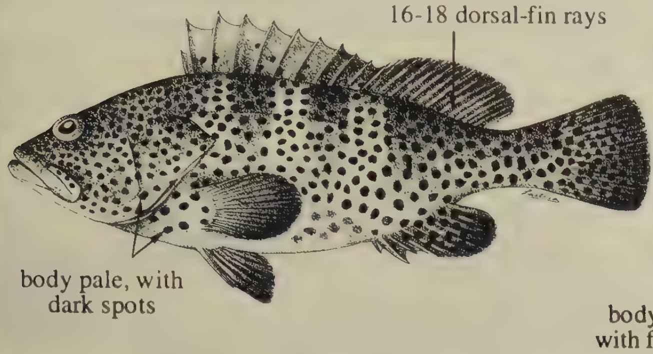

16-18 dorsal-fin rays
body pale, with dark spots

Fig. 148 ***Epinephelus analogus***

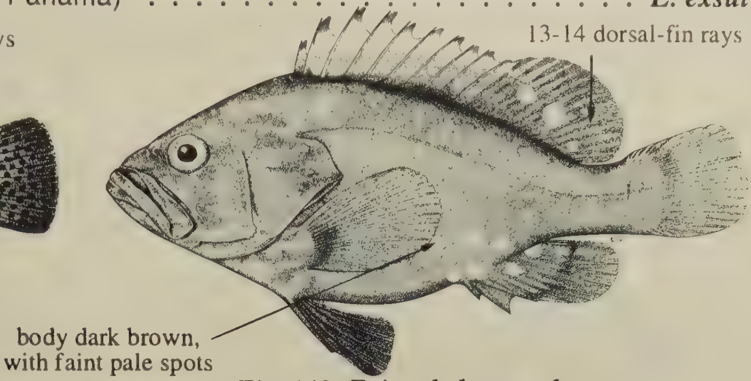

13-14 dorsal-fin rays
body dark brown, with faint pale spots

Fig. 149 ***Epinephelus exsul***

4a. Caudal fin rounded; dorsal-fin rays 15 to 18; anal-fin rays 8; body with spots . . . . → *5*

4b. Caudal-fin rear margin convex or truncate with rounded corners; dorsal-fin rays 13 to 16; anal-fin rays 9; body with or without spots . . . . →*6*

5a. Body reddish brown with pale reticulations and irregular white spots; black saddle blotch on peduncle; third or fourth dorsal-fin spines longest, longer than the longest dorsal-fin rays; dorsal-fin rays 16 to 18 (Fig. 150, Plate XVI) (Gulf of California to Peru, Galapagos Islands) . . . . *E. labriformis*

5b. Body brownish yellow, grey or greenish; head, dorsal part of body, and fins with black spots; 3rd to 11th dorsal-fin spines subequal, shorter than anterior dorsal-fin rays; dorsal-fin rays 15 or 16 (Fig. 151, Plate XVI) (Gulf of California to Peru) . . . . *E. itajara*

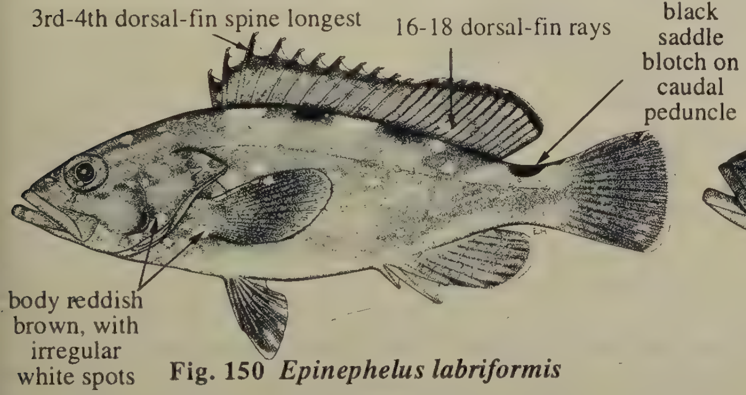

3rd-4th dorsal-fin spine longest
16-18 dorsal-fin rays
black saddle blotch on caudal peduncle
body reddish brown, with irregular white spots

Fig. 150 ***Epinephelus labriformis***

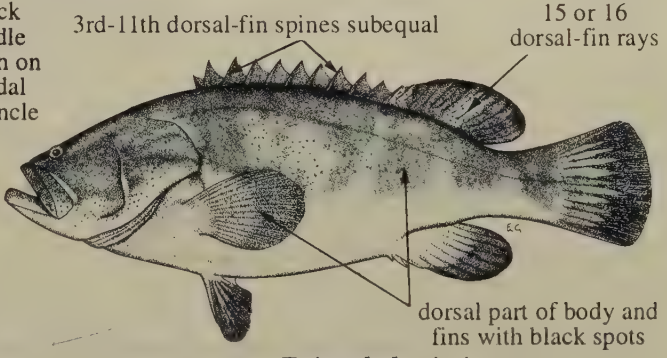

3rd-11th dorsal-fin spines subequal
15 or 16 dorsal-fin rays
dorsal part of body and fins with black spots

Fig. 151 ***Epinephelus itajara***

6a. Body pale brown, with 8 or 9 subvertical dark bars (Fig. 152, Plate XIX) (Galapagos Islands). . . . . *E. mystacinus*

6b. No dark bars on body. . . . . → 7

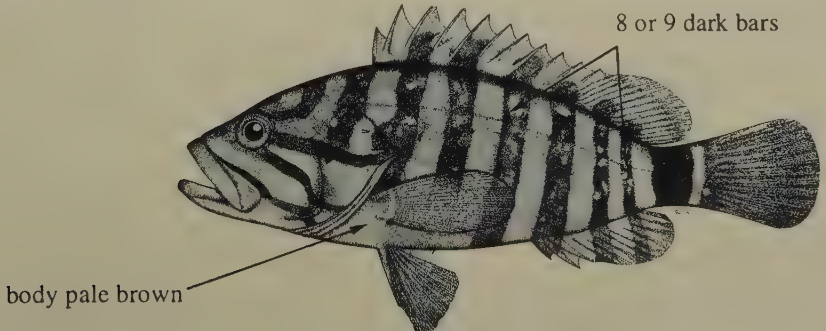

8 or 9 dark bars
body pale brown

Fig. 152 ***Epinephelus mystacinus***

7a. Rear nostrils distinctly larger than anterior nostrils; lower-limb gill rakers 15 to 17; body of juveniles dark reddish brown with white spots in vertical series and horizontal rows, and a black saddle blotch on caudal peduncle; lateral-scale series 100 to 106 (Fig. 153) (southern California to Peru) . . . . *E. niphobles*

7b. Rear nostrils not distinctly larger than front ones; lower gill rakers 17 to 20; juveniles without white spots on body or dark saddle blotch on caudal peduncle; lateral-scale series 131 to 144 (Fig. 154) (Galapagos Islands, Isla del Coco, off Costa Rica) . . . . *E. cifuentesi*

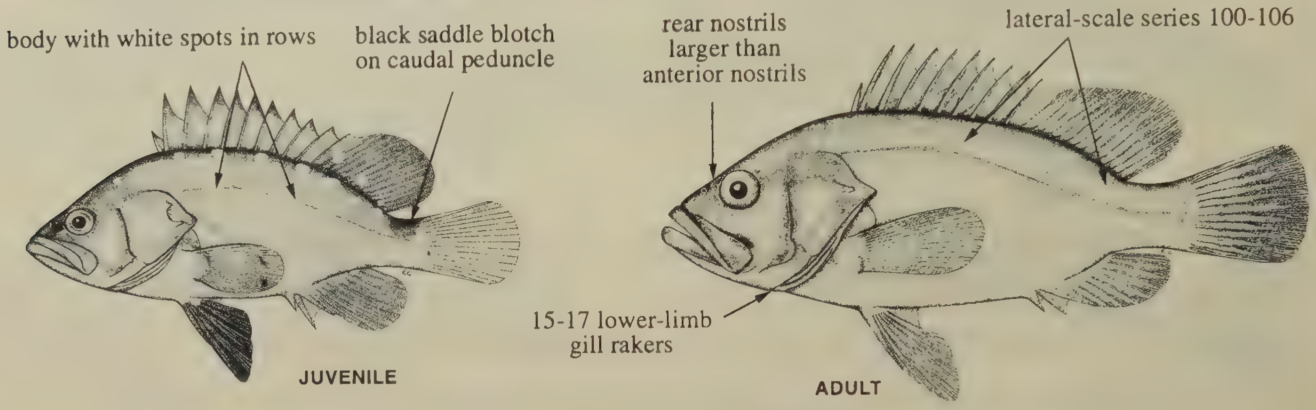

body with white spots in rows
black saddle blotch on caudal peduncle
rear nostrils larger than anterior nostrils
lateral-scale series 100-106
15-17 lower-limb gill rakers
JUVENILE
ADULT

Fig. 153 *Epinephelus niphobles*

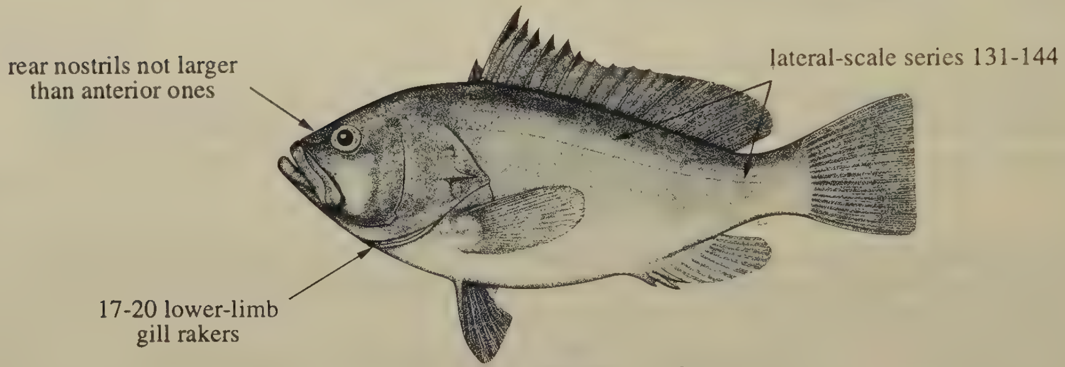

rear nostrils not larger than anterior ones
lateral-scale series 131-144
17-20 lower-limb gill rakers

Fig. 154 *Epinephelus cifuentesi*

Key to the Indo-Pacific Species of *Epinephelus*

1a. Caudal fin of adults emarginate to truncate (slightly rounded on juveniles and some specimens of ***E. bleekeri***, and convex in adults if broadly spread) . . . . → *2*

1b. Caudal fin rounded (some specimens of ***E. latifasciatus*** from the Indian Ocean and some ***E. fasciatus*** from Oceania may have a truncate caudal fin). . . . . →*17*

2a. Interspinous membranes of dorsal fin not incised (Fig. 155) . . . . →*3*

2b. Interspinous membranes of dorsal fin incised (Fig. 156) . . . . →*7*

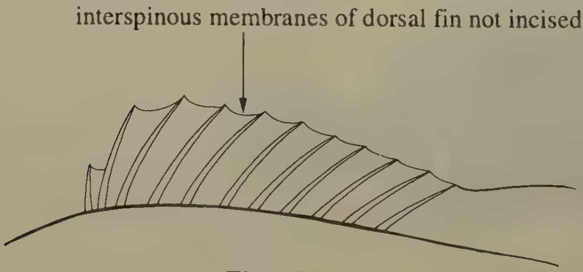

interspinous membranes of dorsal fin not incised

Fig. 155

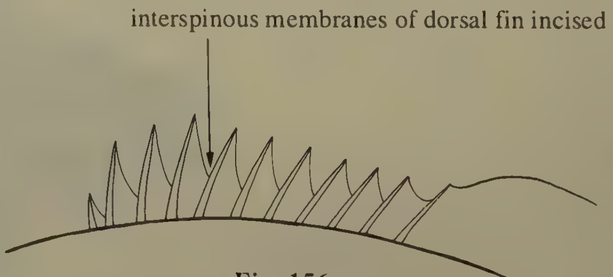

interspinous membranes of dorsal fin incised

Fig. 156

3a. Gill rakers elongate (no rudiments), 12 to 16 on upper limb and 20 to 23 on lower limb; dorsal-fin rays 17 to 19; colour purplish to brownish grey with yellowish brown dots on head and longitudinal brown lines on dorsal part of body (lines usually lost on large adults) (Fig. 157, Plate XXIV) (Kenya to western Pacific) . . . . *E. undulosus*

3b. Gill rakers not elongate and rudiments often present, 6 to 11 on upper limb and 13 to 18 on lower limb; dorsal-fin rays 15 to 17; colour not as in 3a . . . . → *4*

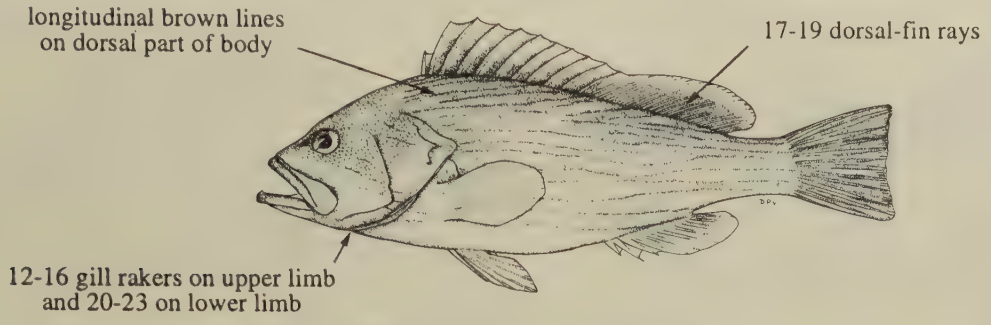

longitudinal brown lines on dorsal part of body
17-19 dorsal-fin rays
12-16 gill rakers on upper limb and 20-23 on lower limb

Fig. 157 ***Epinephelus undulosus***

4a. Second dorsal-fin spine of adults elongate, its length 1.8 to 2.4 times in head length; total gill rakers 20 to 23; body depth 2.7 to 3.2 times in standard length; body reddish brown with a white dot on each scale; broad dark red margin on spinous portion of dorsal fin (Fig. 158, Plate XVI) (Marquesas Islands, and possibly Minami Tori Shima) . . . . *E. irroratus*

4b. Second dorsal-fin spine not elongate (third or fourth spines longest); gill rakers 24 to 28; body depth 2.3 to 2.9 times in standard length; colour not as in 4a. . . . . → *5*

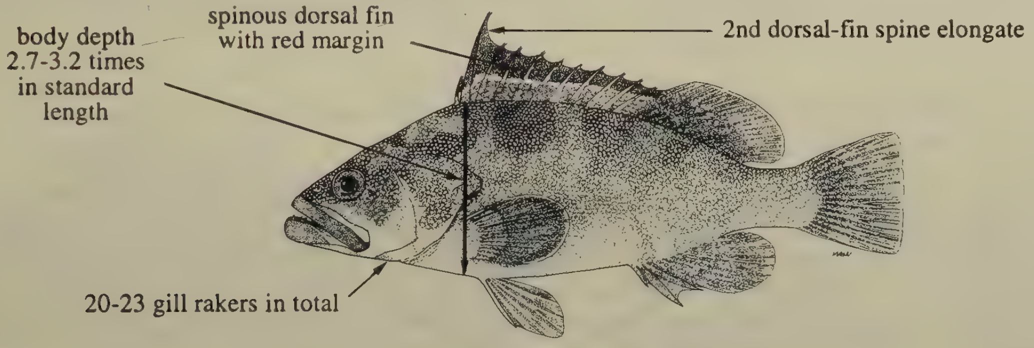

body depth 2.7-3.2 times in standard length
spinous dorsal fin with red margin
2nd dorsal-fin spine elongate
20-23 gill rakers in total

Fig. 158 ***Epinephelus irroratus***

5a. Colour in life usually dark blue or grey, but without black or white spots, the caudal peduncle (at least posteriorly) and fins bright yellow; large adults lose yellow coloration and become chestnut brown, dark blue, grey, or nearly black and have numerous small, irregular pale blue spots that are more conspicuoous underwater; dorsal-fin rays modally 17 (Fig. 159, Plate XIV) (Indian Ocean but not in Red Sea) . . . . *E. flavocaeruleus*

5b. Colour not as in 5a (numerous dark or white spots present); dorsal-fin rays modally 16. . . . . → *6*

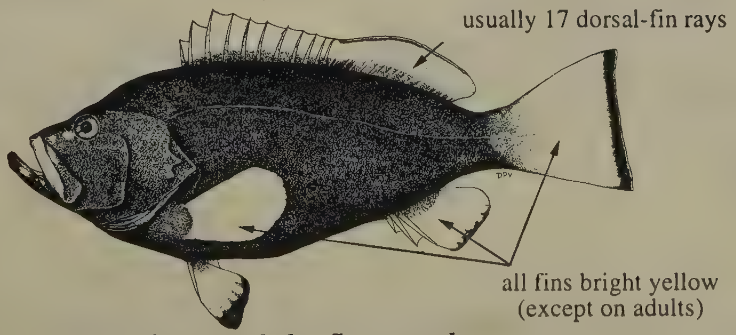

usually 17 dorsal-fin rays
all fins bright yellow (except on adults)

Fig. 159 ***Epinephelus flavocaeruleus***

6a. Body dark purplish grey with scattered irregular whitish blotches; in western Indian Ocean (except Gulf of Oman and Persian Gulf) small dark brown spots on ventral part of body (Fig. 160, Plate XIX) (Indian Ocean) . . . . *E. multinotatus*

6b. Head, body, median, and pelvic fins bluish grey with numerous blackish dots; large adults with scattered irregular blackish spots and blotches, most smaller than pupil (Fig. 161, Plate XI) (central to western Pacific). . . . . *E. cyanopodus*

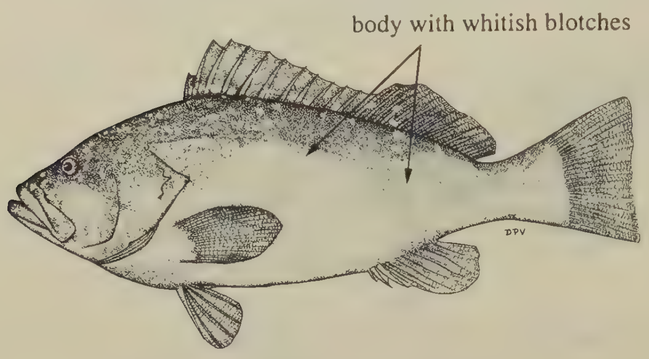

body with whitish blotches

Fig. 160 *Epinephelus multinotatus*

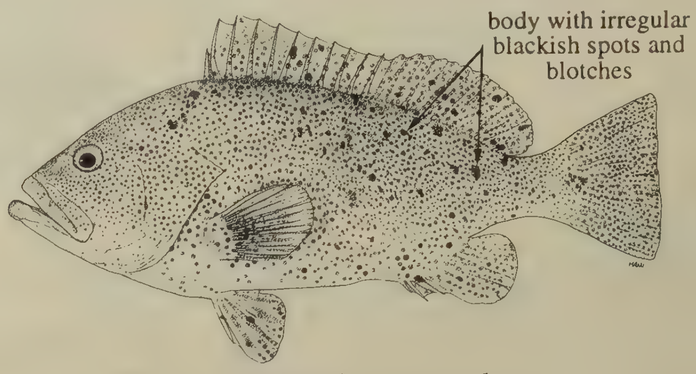

body with irregular blackish spots and blotches

Fig. 161 *Epinephelus cyanopodus*

7a. Lateral-line scales 48 to 54; head and at least front of body with small spots, either yellow (pale in preservative) or brown . . . . → *8*

7b. Lateral-line scales 56 to 76; small spots on head and body dark brown or absent . . . . → *12*

8a. Dorsal-fin rays 14 or 15; serrae at corner of preopercle slightly enlarged (about 1.5 times longer than those above corner); body depth 3.2 to 3.6 times in standard length (Fig. 162, Plate XIV) (Somalia to southern Oman) . . . . *E. gabriellae*

8b. Dorsal-fin rays 16 to 18 (rarely 15 in ***E. areolatus***); serrae at corner of preopercle about 3 to 5 times longer than those above corner . . . . → *9*

9a. Caudal fin truncate to slightly rounded; body depth 3.0 to 3.5 times in standard length; head, body, dorsal fin, and upper third of caudal fin with small orange-yellow spots, the lower two-thirds of caudal fin dark grey; dorsal-fin rays modally 17 (Fig. 163, Plate IX) (India to Taiwan, Hong Kong and Philippines). . . . . *E. bleekeri*

9b. Caudal fin slightly emarginate (truncate on some specimens of ***E. chlorostigma***); body depth 2.7 to 3.3 times in standard length; spots on head, body, and fins yellow or yellowish brown to dark brown, the caudal fin entirely spotted; dorsal-fin rays modally 16 (except ***E. chlorostigma*** with 17) . . . . → *10*

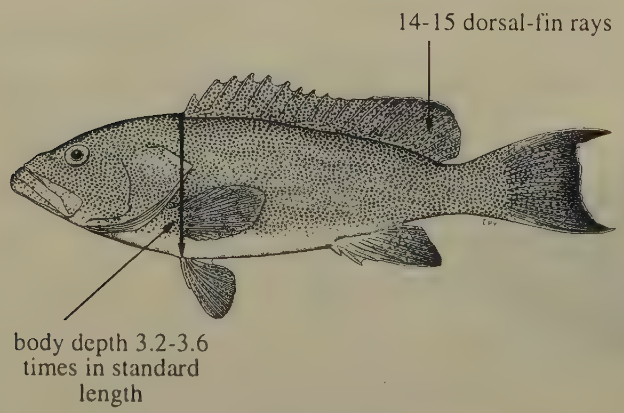

14-15 dorsal-fin rays
body depth 3.2-3.6 times in standard length

Fig. 162 *Epinephelus gabriellae*

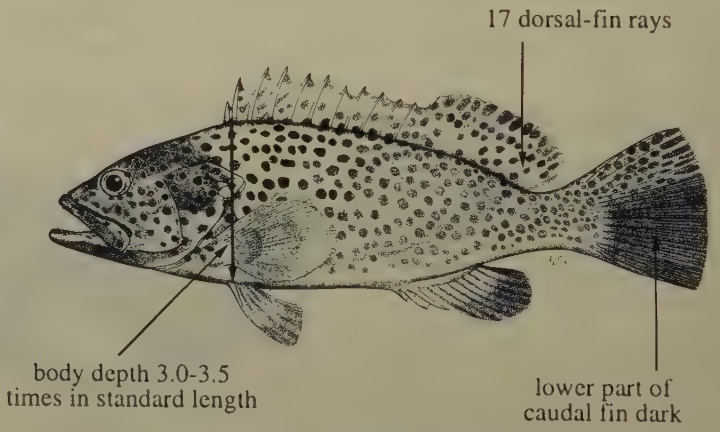

17 dorsal-fin rays
body depth 3.0-3.5 times in standard length
lower part of caudal fin dark

Fig. 163 *Epinephelus bleekeri*

10a. Head and front of body with small round well-separated bright yellow spots (pale in preservative); distal margin of caudal, soft dorsal, and anal fins with close-set dark yellowish brown spots (Fig. 164, Plate XXIV) (Timor Sea, Western Australia, Fiji, Phoenix Islands, and Samoa; in deep water) . . . . *E. timorensis*

10b. Head and body with small close-set yellowish brown to dark brown spots (dark in preservative); fins with small dark spots . . . . → *11*

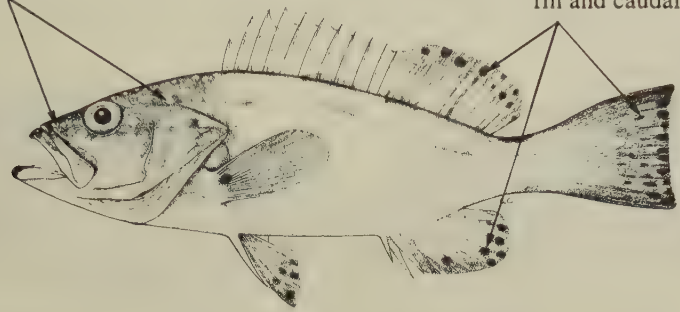

head with bright yellow spots
distal margin of soft dorsal fin, anal fin and caudal fin with dark spots

Fig. 164 *Epinephelus timorensis*

11a. Dorsal-fin rays 15 to 17; margin of anal fin of adults rounded to slightly angular, the longest ray 2.0 to 2.6 times in head length; lower gill rakers 14 to 16; pyloric caeca 11 to 17; dark spots on body of adults subequal to pupil (Fig. 165, Plate VIII) (Red Sea to western Pacific) . . . . *E. areolatus*

11b. Dorsal-fin rays 16 to 18; anal fin of adults angular or pointed, the longest ray 1.9 to 2.3 times in head length; lower gill rakers 15 to 18; pyloric caeca 26 to 52; largest dark spots on body of adults distinctly smaller than pupil (Fig. 166, Plate X) (Red Sea to western Pacific) . . . . *E. chlorostigma*

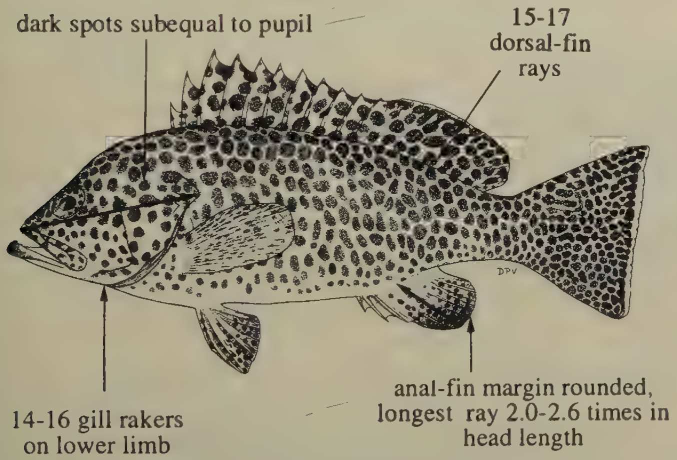

dark spots subequal to pupil
15-17 dorsal-fin rays
DPV
14-16 gill rakers on lower limb
anal-fin margin rounded, longest ray 2.0-2.6 times in head length

Fig. 165 *Epinephelus areolatus*

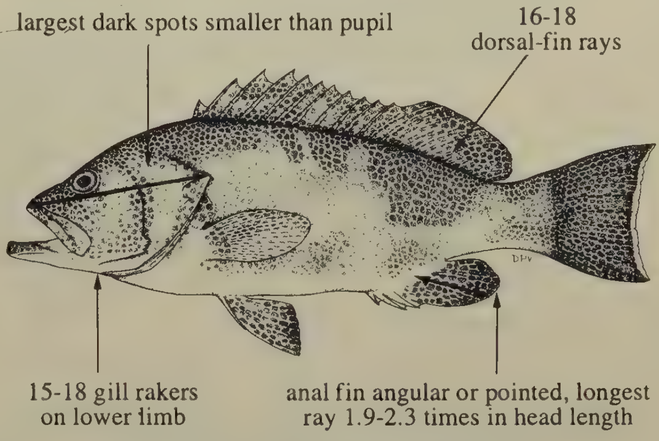

largest dark spots smaller than pupil
16-18 dorsal-fin rays
DPV
15-18 gill rakers on lower limb
anal fin angular or pointed, longest ray 1.9-2.3 times in head length

Fig. 166 *Epinephelus chlorostigma*

12a. Anal-fin rays 9 (rarely 8); 1 to 4 small spines often present on ventral edge of preopercle near corner; dorsal-fin rays 13 to 15; posterior nostrils of adults 2 to 4 times larger than anteriors. . . . . → *13*

12b. Anal-fin rays 8; no spines on lower edge of preopercle; dorsal-fin rays 14 to 17; posterior nostrils not enlarged (except *E. darwinensis*). . . . . → *14*

13a. Juveniles brown, with 7 dark brown bars on body, the last covering most of caudal peduncle, its upper half black; distance between fourth and fifth dark bars greater than that between third and fourth and fifth and sixth dark bars; adults pinkish grey without bars, the fins darker except for broad pale margins on caudal fin and soft dorsal fin; skin of body wrinkled in a narrow zone along base of dorsal fin; no auxiliary scales on body; no scales on maxilla (Fig. 167, Plate XII) (eastern Australia from 18° to 36°S) . . . . *E. ergastularius*

13b. Juveniles greyish brown, with 3 faint dark bars on dorsal part of body and a dark brown saddle spot on peduncle; large adults grey-brown; no wrinkles on body at base of dorsal fin; adults with auxiliary scales; small embedded scales on maxilla (Fig. 168, Plate X) (Kenya to South Africa) . . . . *E. chabaudi*

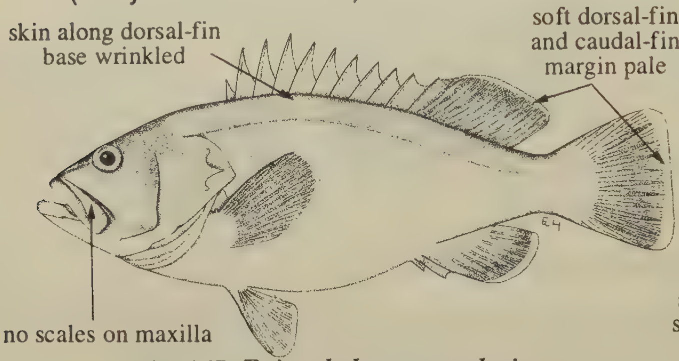

skin along dorsal-fin base wrinkled
soft dorsal-fin and caudal-fin margin pale
no scales on maxilla

Fig. 167 *Epinephelus ergastularius*

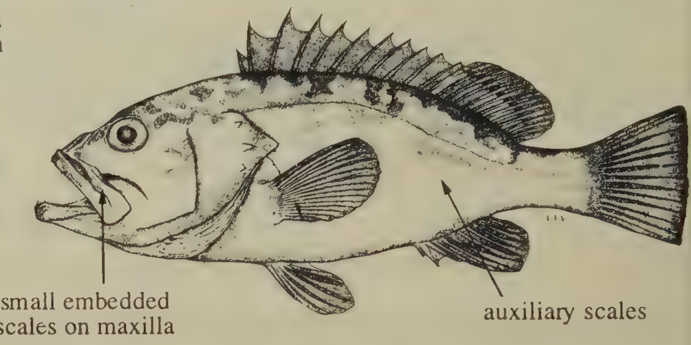

small embedded scales on maxilla
auxiliary scales

Fig. 168 *Epinephelus chabaudi*

14a. Dorsal-fin rays 14; lateral-line scales 56 to 66; body and rear of head with well-separated dark brown spots; prominent dark brown maxillary streak; soft dorsal and anal fins dusky distally, with prominent white edge; margin of interspinous dorsal-fin membranes usually orange-yellow (Fig. 169, Plate VII) (southern Mozambique to South Africa) . . . *E. albomarginatus*

14b. Dorsal-fin rays 16 or 17; lateral-line scales 64 to 76; colour not as in 14a (brown spots, if present, close-set) . . . . → *15*

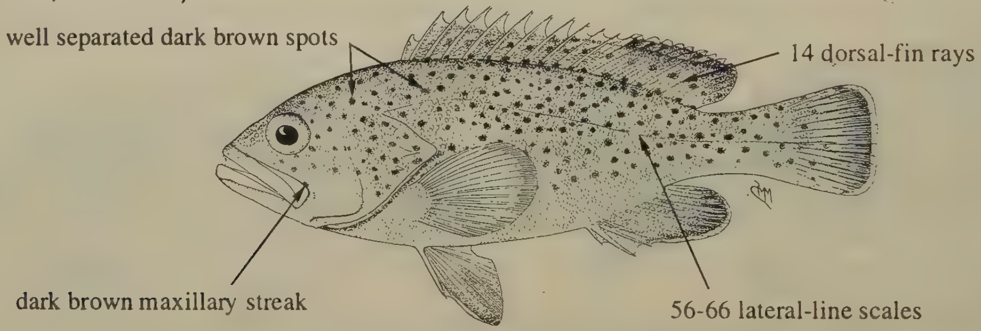

well separated dark brown spots
14 dorsal-fin rays
dark brown maxillary streak
56-66 lateral-line scales

Fig. 169 *Epinephelus albomarginatus*

15a. Head, body and fins with numerous close-set small dark brown spots; rear margin of caudal fin with white edge; 2 rows of teeth on midside of lower jaw (Fig. 170, Plate XX) (Gulf of Aden and Persian Gulf to India) . . . . *E. polylepis*

15b. No dark spots on head, body or fins; no white margin posteriorly on caudal fin; 3 or 4 rows of teeth on midside of lower jaw . . . . → *16*

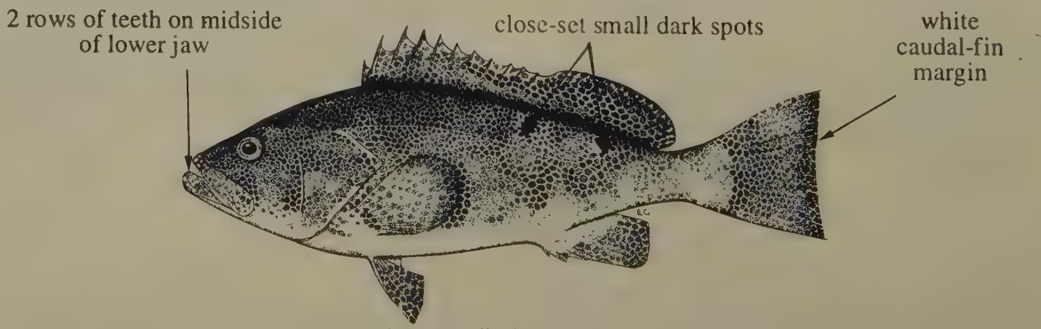

2 rows of teeth on midside of lower jaw
close-set small dark spots
white caudal-fin margin

Fig. 170 *Epinephelus polylepis*

16a. Caudal fin truncate to slightly convex; nostrils subequal; pectoral-fin rays 19 to 20; caudal peduncle depth 3.2 to 3.8 times in head length; no scales on maxilla; margin of interspinous dorsal-fin membranes dark red to black (Fig. 171, Plate XXI) (Indo-Pacific) . . . . *E. retouti*

16b. Caudal fin slightly emarginate; posterior nostrils of adults more than twice diameter of anteriors; pectoral-fin rays 18; caudal-peduncle depth 3.9 times in head length; maxilla with small scales; no conspicuous markings on head, body or spinous dorsal fin (Fig. 172, Plate XI) (1 specimen, 53 cm standard length, Timor Sea) . . . . *E. darwinensis*

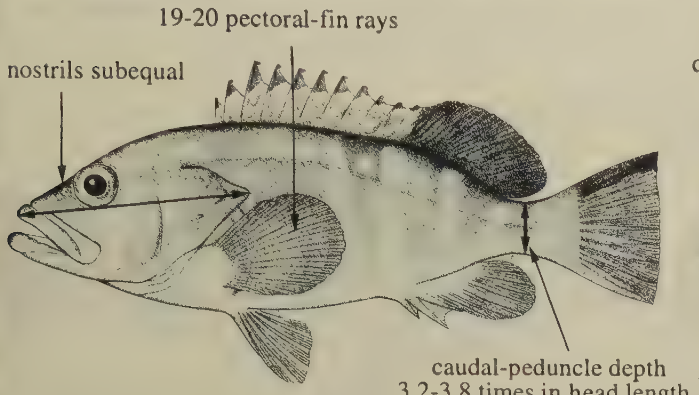

19-20 pectoral-fin rays
nostrils subequal
caudal-peduncle depth 3.2-3.8 times in head length

Fig. 171 *Epinephelus retouti*

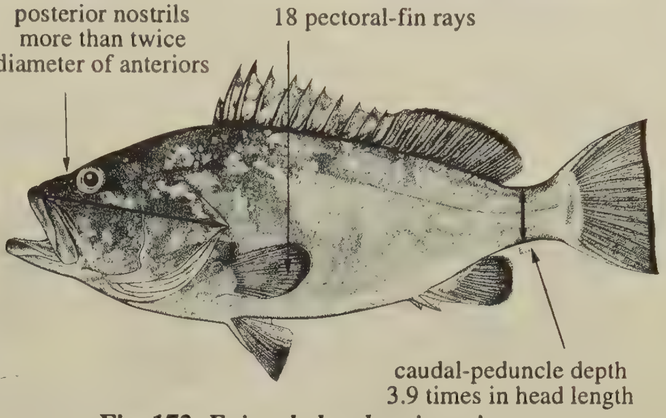

posterior nostrils more than twice diameter of anteriors
18 pectoral-fin rays
caudal-peduncle depth 3.9 times in head length

Fig. 172 *Epinephelus darwinensis*

17a. Anal-fin rays 9 (rarely 10). . . . . →*18*

17b. Anal-fin rays 8 (rarely 7 or 9) . . . . →*21*

18a. Dorsal-fin rays 16; scales smooth and mostly embedded; lateral-scale series 87 to 108; body depth 3.15 to 3.6 times in standard length; nostrils subequal; interorbital space flat; pale with reddish brown spots on head and body; interspinous dorsal-fin membranes with alternating dark brown and white stripes (Fig. 173, Plate XXI) (Madagascar, Mozambique, and South Africa) . . . . *E. posteli*

18b. Dorsal-fin rays 14 to 15; scales on body ctenoid (rough) and mostly exposed; lateral-scale series 103 to 139; body depth 2.3 to 3.0 times in standard length; rear nostrils of adults vertically ovate, their diameter 2 or more times larger than anterior nostrils; interorbital space convex; no small dark spots on head or body; no dark stripes in dorsal fin. . . . . →*19*

19a. No small spinules on ventral edge of preopercle; lateral-scale series 122 to 139; juveniles dark greyish brown, with 8 vertical series of white spots on body (Fig. 174, Plate XXI) (Hawaiian Islands) . . . . *E. quernus*

19b. Lower edge of preopercle with 1 to 4 serrae anterior to serrae at corner; juveniles with dark bars on body; lateral-scale series 103 to 128 . . . . →*20*

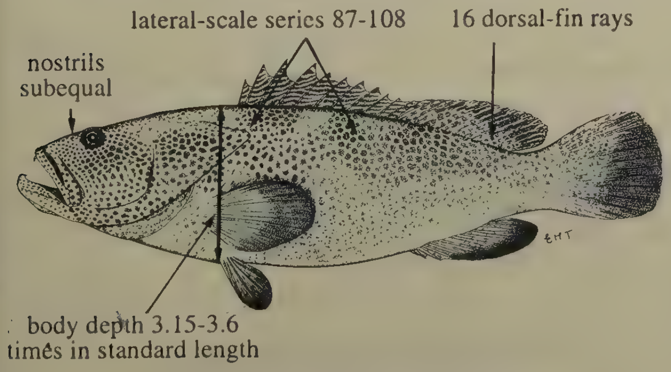

lateral-scale series 87-108
16 dorsal-fin rays
nostrils subequal
body depth 3.15-3.6 times in standard length

Fig. 173 *Epinephelus posteli*

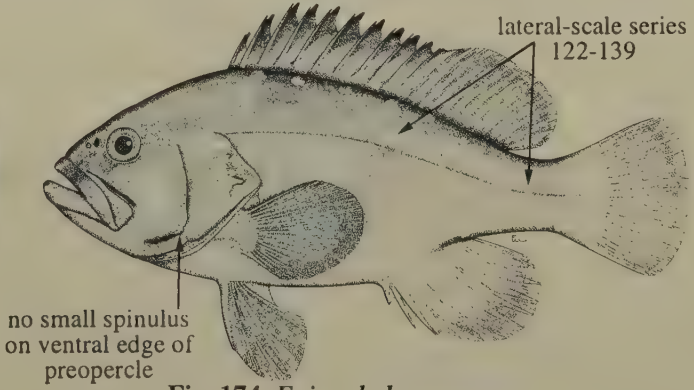

lateral-scale series 122-139
no small spinulus on ventral edge of preopercle

Fig. 174 *Epinephelus quernus*

20a. Body with 6 dark bars below dorsal fin, the last 2 bars close set and much narrower than preceding bar; 3 pale interspaces below soft dorsal fin; greatest diameter of rear nostrils more than distance from nostril to eye; ratio of caudal-peduncle length/depth = 1.2-1.5 (Fig. 175, Plate XXII) (Japan, Korea, and China) . . . . ***E. septemfasciatus***

20b. Body with 5 dark bars below dorsal fin, the last 2 bars as broad as preceding bars; 2 pale interspaces below soft dorsal fin; rear nostril diameter not more than distance from nostril to eye; ratio of peduncle length/depth = 0.9-1.2 (Fig. 176, Plate XX) (Indo-Pacific but not in Red Sea or Persian Gulf, in deep water) . . . . ***E. octofasciatus***

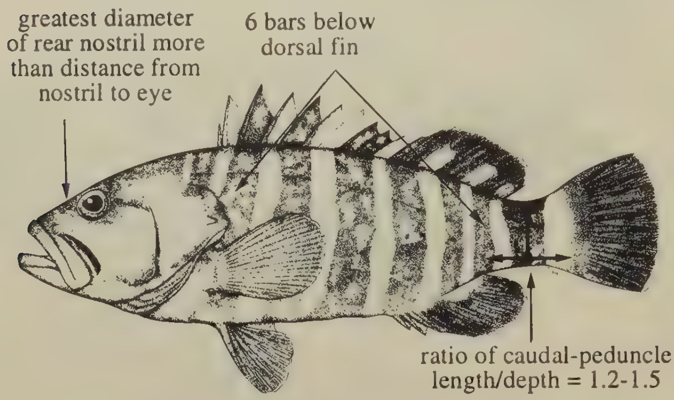

greatest diameter of rear nostril more than distance from nostril to eye
6 bars below dorsal fin
ratio of caudal-peduncle length/depth = 1.2-1.5

Fig. 175 ***Epinephelus septemfasciatus***

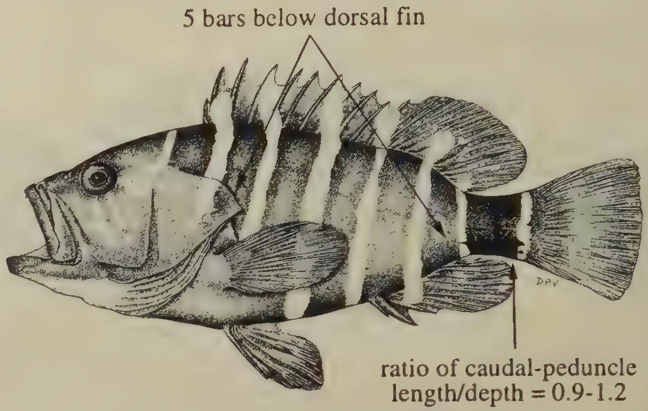

5 bars below dorsal fin
ratio of caudal-peduncle length/depth = 0.9-1.2

Fig. 176 ***Epinephelus octofasciatus***

21a. Dorsal-fin rays 12 or 13 (rarely 13) . . . . → *22*

21b. Dorsal-fin rays 14 to 18 (rarely 13 in ***E. bruneus***). . . . . → *23*

22a. Lateral-line scales 52; lateral-body scales ctenoid (rough); maxilla naked; rear nostrils twice as large as anterior nostrils; no obvious dark or light markings (Fig. 177) (1 specimen, 465 mm standard length, from Queensland, Australia) . . . . ***E. perplexus***

22b. Lateral-line scales 56 to 65; lateral-body scales smooth; small scales usually present on maxilla; nostrils subequal; juveniles (<20 cm standard length) with 2 broad, longitudinal, black-edged whitish bands that disappear in adults, the dark edges breaking into dashes and spots (may be lost in large adults) (Fig. 178, Plate XVI) (Red Sea to southern Japan) . . . . ***E. latifasciatus***

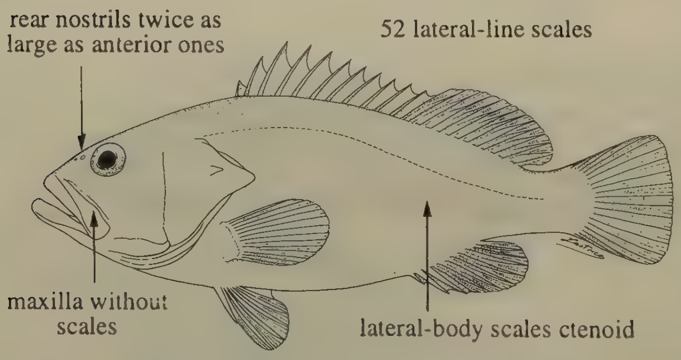

rear nostrils twice as large as anterior ones
52 lateral-line scales
maxilla without scales
lateral-body scales ctenoid

Fig. 177 ***Epinephelus perplexus***

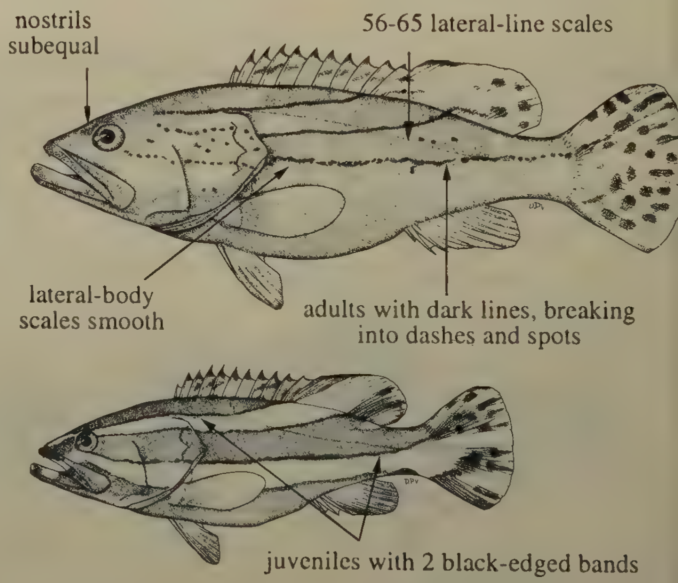

nostrils subequal
56-65 lateral-line scales
lateral-body scales smooth
adults with dark lines, breaking into dashes and spots
juveniles with 2 black-edged bands

Fig. 178 ***Epinephelus latifasciatus***

23a. Lateral-line scales with branched tubules; eye diameter contained about 8 times in head length at 20 cm standard length, about 9 times in head length at 35 cm, and 13 times in head length for 145 cm fish; maximum total length about 2.7 m; juveniles yellow, with 3 broad black bars on body and irregular broad black bands on head (Fig. 179, Plate XVI) (Indo-Pacific) . . . . *E. lanceolatus*

23b. Lateral-line scales with a single tubule (except anterior scales of large ***E. brunneus***, ***E. coioides*** and ***E. malabaricus***); eye diameter contained less than 7 times in head length of 20 cm fish and less than 8 times in head length for 35 cm fish; maximum total length less than 1.5 m (except ***E. tukula***, which may reach 2 m); juveniles not coloured as in 23a . . . . → *24*

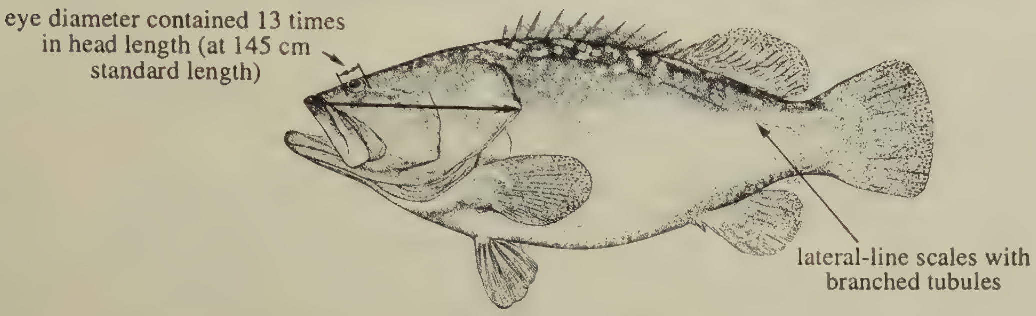

eye diameter contained 13 times in head length (at 145 cm standard length)
lateral-line scales with branched tubules

Fig. 179 ***Epinephelus lanceolatus***

24a. Numerous distinct dark spots (not dots) over most of head and body (spots brownish red to black in life and distinct in preservative) (see Fig. 180) . . . . → *25*

24b. No distinct dark spots over most of head and body (there may be yellow or orange spots in life, but these usually do not persist in alcohol; or there may be dark dots or scattered small dark spots, but not over most of head and body) (see Figs 209, 210) . . . . → *49*

25a. Lateral-line scales 46 to 53 . . . . → *26*

25b. Lateral-line scales 53 to 74 . . . . → *37*

26a. Midlateral-body scales smooth, at least on adults (may be ctenoid in area covered by pectoral fins) . . . . → *27*

26b. Midlateral-body scales rough (mainly smooth on large adults of ***E. andersoni*** and ***E. socialis***). . . . . → *30*

27a. Dorsal profile of head nearly straight; orange-red to brownish red spots on head, body, and median and pelvic fins; 3 or 4 prominent black spots or blotches dorsally on body, the first (and largest, greater than orbit diameter) at base of middle of dorsal fin, the last blotch dorsally on caudal peduncle; no blackish maxillary streak (Fig. 180, Plate XXIV) (Korea and southern Japan to Taiwan and China) . . . . *E. trimaculatus*

27b. Dorsal profile of head convex; spots on head, body, and fins dark brown to black; black blotches on body at base of dorsal fin present or absent; blackish maxillary streak usually present . . . . . → *28*

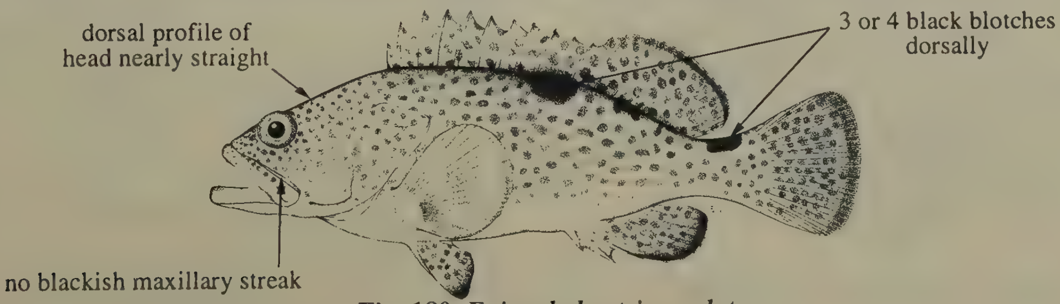

dorsal profile of head nearly straight
3 or 4 black blotches dorsally
no blackish maxillary streak

Fig. 180 ***Epinephelus trimaculatus***

28a. Dorsal-fin rays 16 to 18; dark spots on pectoral fins progressively smaller distally; pelvic-fin length 2.2 to 2.6 times in head length (Fig. 181, Plate XIII) (India, Sri Lanka and Indonesia) . ***E. faveatus***

28b. Dorsal-fin rays 15 to 17; no dark spots on distal part of pectoral fins; pelvic-fin length 1.9 to 2.3 times in head length (at standard length less than 25 cm). . . . . → *29*

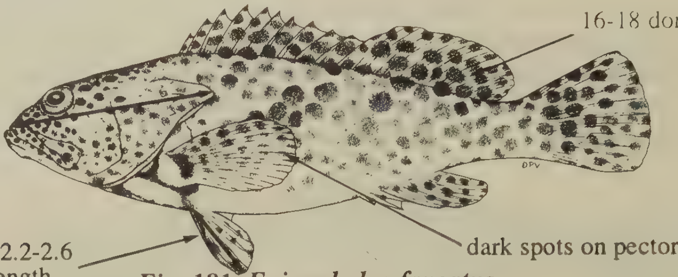

16-18 dorsal-fin rays
pelvic-fin length 2.2-2.6 times in head length
dark spots on pectoral fin smaller distally

Fig. 181 ***Epinephelus faveatus***

29a. Large blackish blotch (containing 4 to 7 black spots) on body at base of last 3 dorsal-fin spines; dark spots on head, body, and fins numerous, 17 on soft dorsal fin of a 10 cm standard length fish and 28 dark spots on the fin of a 28 cm fish; pectoral-fin rays 17 to 19 (rarely 19); total gill rakers 23 to 26 (modally 25); body width 1.7 to 2.2 times in body depth; lower jaw not strongly projecting (Fig. 182, Plate XV) (Oceania and western Pacific). . ***E. howlandi***

29b. No large blackish blotch at base of posterior dorsal-fin spines (though 1 to 3 spots at this location are usually darker than adjacent spots); dark spots on head, body, and fins less numerous, 5 to 7 on soft dorsal fin of a 11 cm fish and 20 to 21 dark spots on the fin of a 29 cm fish; pectoral-fin rays 18 or 19 (often 19); total gill rakers 21 to 24 (modally 23); body width 1.4 to 1.8 times in body depth; lower jaw strongly projecting (Fig. 183, Plate XVII) (Indo-Pacific but not in Red Sea or Persian Gulf) . . . . ***E. macrospilos***

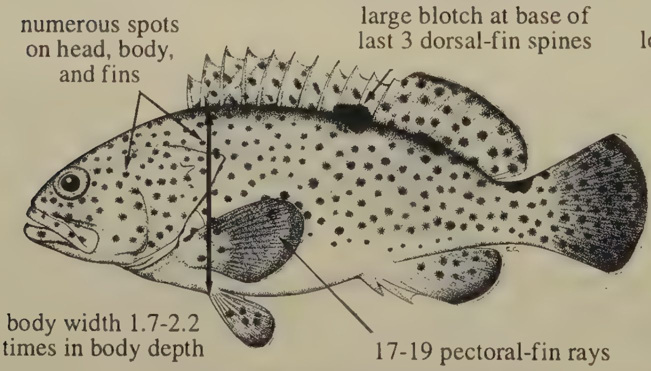

numerous spots on head, body, and fins
large blotch at base of last 3 dorsal-fin spines
body width 1.7-2.2 times in body depth
17-19 pectoral-fin rays

Fig. 182 ***Epinephelus howlandi***

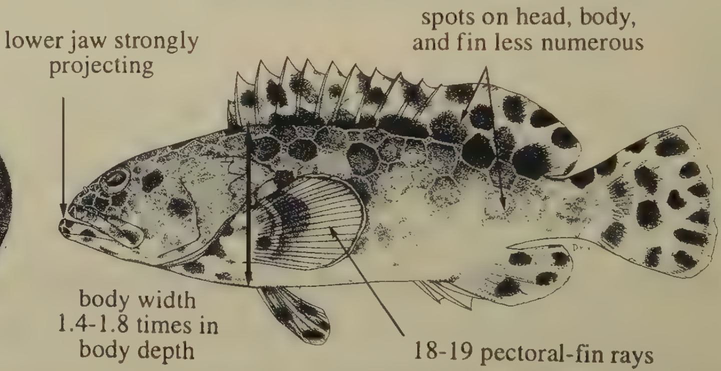

lower jaw strongly projecting
spots on head, body, and fin less numerous
body width 1.4-1.8 times in body depth
18-19 pectoral-fin rays

Fig. 183 ***Epinephelus macrospilos***

30a. Dark spots on body elongate, oblique, and more numerous posteriorly; dark spots on head separated by more than 2 spot diameters (Fig. 184); ventral edge of maxilla of subadults (33 to 40 cm standard length) a distinct step-like shape that develops into a bony knob in adults (Fig. 185, Plate XVII) (Indian Ocean and Indonesia) . . . . ***E. longispinis***

30b. Dark spots on body not elongate and not more numerous posteriorly; dark spots on head separated by less than a spot diameter (except ***E. bontoides***); no distinct step-like shape to ventral edge of maxilla (Fig. 185) . . . . → *31*

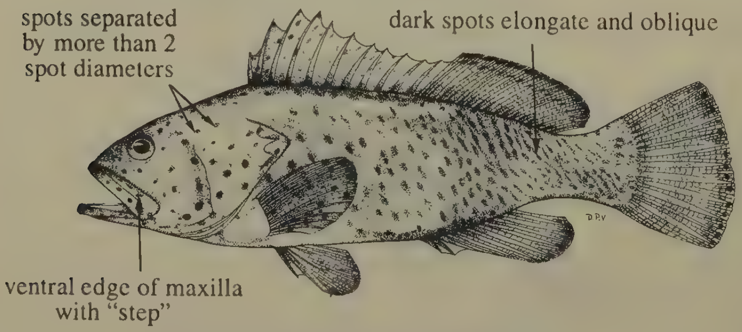

spots separated by more than 2 spot diameters
dark spots elongate and oblique
ventral edge of maxilla with "step"

Fig. 184 ***Epinephelus longispinis***

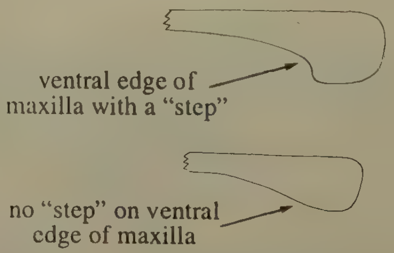

ventral edge of maxilla with a "step"
no "step" on ventral edge of maxilla

Fig. 185

31a. Pectoral-fin length 1.2 to 1.6 times in head length (except fish from northwest Australia); dorsal-fin rays 16 to 18; serrae at corner of preopercle distinctly enlarged (Fig. 186); 2 oblique dark brown bands (or elongate dark blotches linked by narrow bands) on chest (Fig. 187, Plate XXI) (Andaman Islands and western Pacific). . . . . *E. quoyanus*

31b. Pectoral-fin length 1.5 to 2.0 times in head length; dorsal-fin rays 14 to 17; serrae at corner of preopercle slightly enlarged (Fig. 186); no oblique dark bands on chest . . . . → *32*

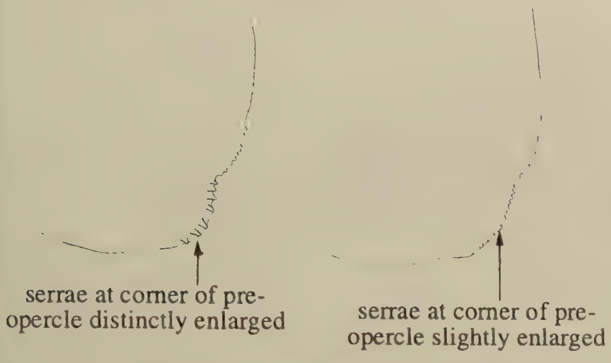

serrae at corner of preopercle distinctly enlarged
serrae at corner of preopercle slightly enlarged

Fig. 186

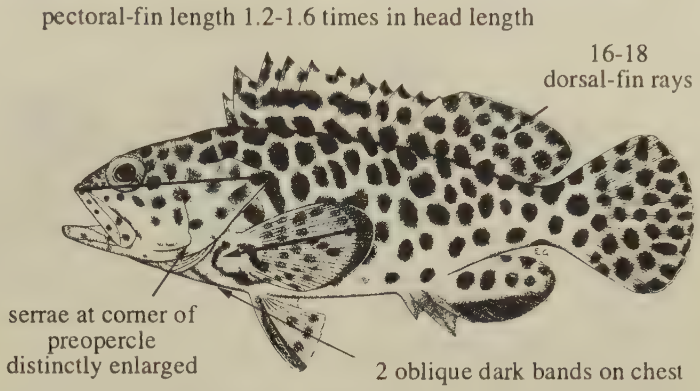

pectoral-fin length 1.2-1.6 times in head length
16-18 dorsal-fin rays
serrae at corner of preopercle distinctly enlarged
2 oblique dark bands on chest
E.G.

Fig. 187 ***Epinephelus quoyanus***

32a. Lateral-scale series 82 to 86; pectoral-fin rays 18 or 19; total gill rakers 20 to 22; head and body with small dark spots separated by spaces greater than 2 spot diameters; no dark spots on ventral parts of head and body; caudal, soft dorsal, and pectoral fins blackish brown with a pale yellow to white margin (Fig. 188, Plate IX) (Taiwan to Indonesia and New Britain). . . . . *E. bontoides*

32b. Lateral-scale series 92 to 120; pectoral-fin rays 16 to 19; total gill rakers 23 to 27 (except ***E. merra*** with 21 to 25); dark spots on head and body extending ventrally, and most within a spot diameter of adjacent spots; fins not dark brown to black with a distinct pale margin . . . → *33*

33a. Dorsal-fin rays 14 or 15; longest dorsal-fin spine 2.7 to 3.3 times in head length; a black saddle-blotch on caudal peduncle; head and body covered by small orange-brown to dark brown spots; head and dorsal part of body with irregular dark brown blotches superimposed over the dark spots (Fig. 189, Plate XX) (Indo-Pacific). . . . . *E. polyphekadion*

33b. Dorsal-fin rays 15 to 18; longest dorsal-fin spines 2.1 to 2.7 times in head length (except ***E. merra*** with 2.6 to 2.9 times in head length); colour not as in 33a (especially, no black saddle on caudal peduncle). . . . . → *34*

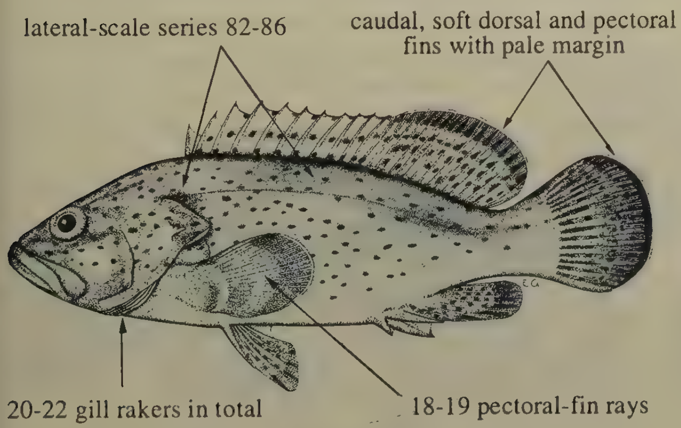

lateral-scale series 82-86
caudal, soft dorsal and pectoral fins with pale margin
20-22 gill rakers in total
18-19 pectoral-fin rays
E.G.

Fig. 188 ***Epinephelus bontoides***

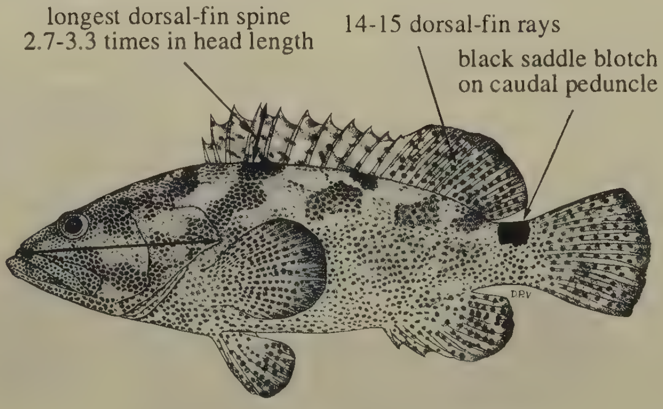

longest dorsal-fin spine 2.7-3.3 times in head length
14-15 dorsal-fin rays
black saddle blotch on caudal peduncle
DRV

Fig. 189 ***Epinephelus polyphekadion***

34a. Dark spots on head and body less than half size of pupil; dark brown to black spots on fins (except spinous dorsal fin) much larger than those on body (Fig. 190, Plate XVIII); maxilla reaching a vertical at rear edge of orbit (Fig. 191) (Indo-Pacific but not in Red Sea) . . . *E. miliaris*

34b. Dark spots on body larger than pupil; dark spots on fins smaller than those on body; maxilla usually reaching to or past a vertical at rear edge of orbit (Fig. 191). . . . . → *35*

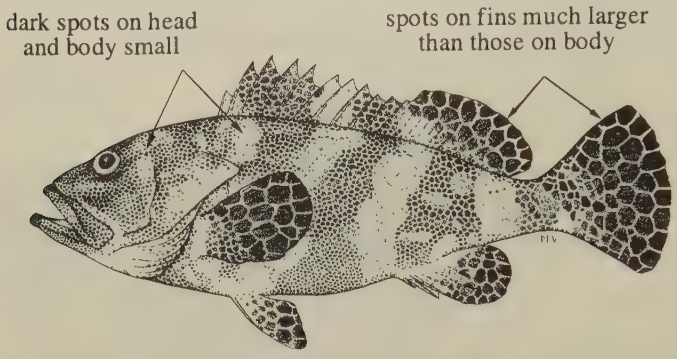

dark spots on head and body small
spots on fins much larger than those on body

Fig. 190 ***Epinephelus miliaris***

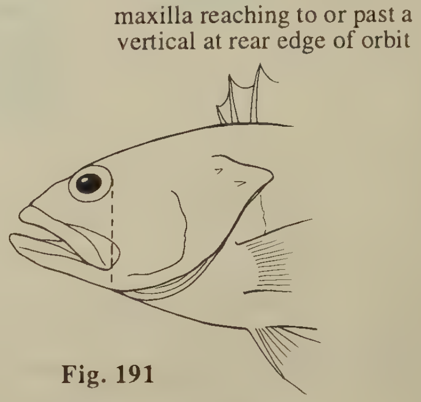

maxilla reaching to or past a vertical at rear edge of orbit

Fig. 191

35a. Pectoral-fin rays 16 to 18; longest dorsal-fin spine 2.6 to 2.9 times in head length; some dark brown spots on body often joined to form short horizontal or oblique bands; black spots on pectoral fins very small and largely confined to rays (Fig. 192, Plate XVIII) (Indo-Pacific but not in Red Sea) . . . . *E. merra*

35b. Pectoral-fin rays 17 to 19; longest dorsal-fin spines 2.1 to 2.6 times in head length; no confluent dark spots on body; dark spots on pectoral fins not uniformly small and not confined to rays . . . → *36*

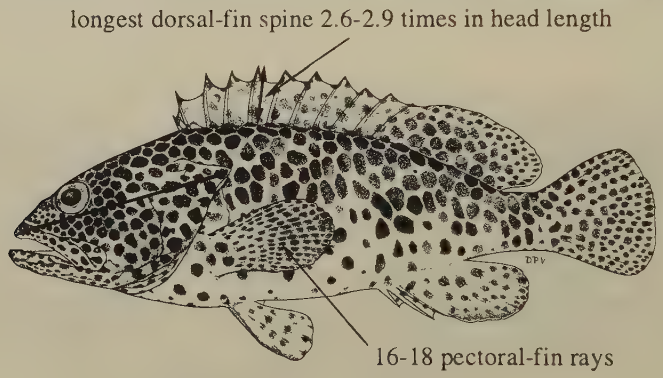

longest dorsal-fin spine 2.6-2.9 times in head length
16-18 pectoral-fin rays

Fig. 192 ***Epinephelus merra***

36a. Dorsal-fin rays 17 or 18; lateral-scale series 94 to 102; 3 close-set pairs of dark brown to black spots on body at base of dorsal fin (Fig. 193) (Western Australia). . . . . *E. bilobatus*

36b. Dorsal-fin rays 15 to 17; lateral-scale series 102 to 120; no pairs of dark brown to black spots along base of dorsal fin; 2 large dusky to blackish areas on body and dorsal fin, these separated by a broad whitish (though still faintly spotted) area (Fig. 194, Plate XVII) (central and western Pacific) . . . . *E. maculatus*

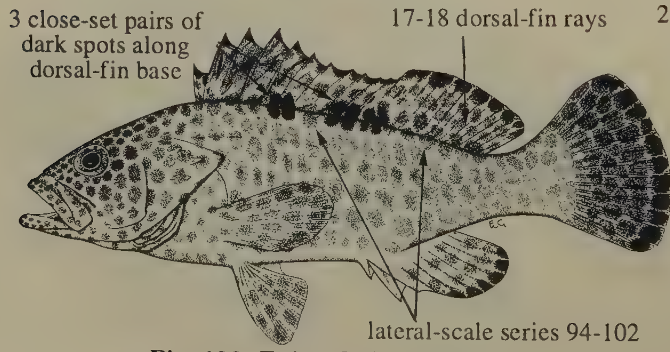

3 close-set pairs of dark spots along dorsal-fin base
17-18 dorsal-fin rays
lateral-scale series 94-102

Fig. 193 ***Epinephelus bilobatus***

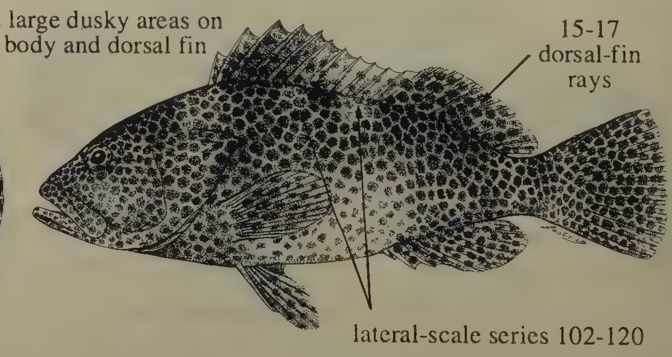

2 large dusky areas on body and dorsal fin
15-17 dorsal-fin rays
lateral-scale series 102-120

Fig. 194 ***Epinephelus maculatus***

37a. Dorsal-fin rays 17; pectoral-fin rays 20; lateral-line scales 73; body broadly marbled with brown and finely spotted with dark brown (Fig. 195) (1 specimen, 248 mm standard length, locality unknown). . . . . ***E. lebretonianus***

37b. Dorsal-fin rays 13 to 17 (only ***E. corallicola*** rarely with 17); pectoral-fin rays 17 to 20; lateral-line scales less than 71 (except ***E. andersoni*** and ***E. tauvina***); colour not entirely as in 37a. . . . . → *38*

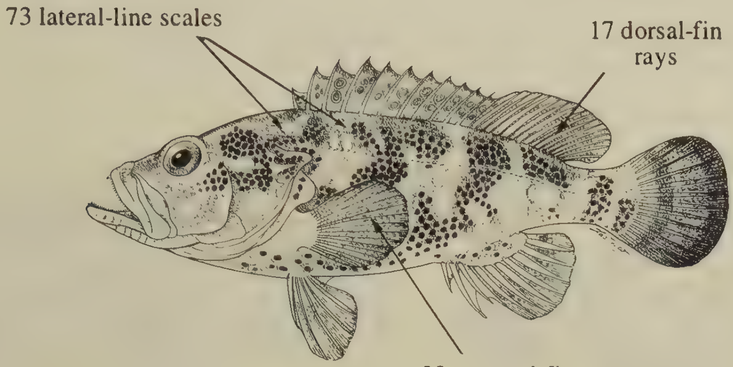

73 lateral-line scales
17 dorsal-fin rays
20 pectoral-fin rays

Fig. 195 ***Epinephelus lebretonianus***

38a. Most dark spots on body polygonal and close-set, separated only by pale lines (forming a reticulum) or white dots; midlateral-body scales rough (see Fig. 196). . . . . → *39*

38b. Most dark spots on body round or oblong and well-separated (except posteriorly on ***E. socialis*** where spots may be confluent to form irregular dark stripes); midlateral-body scales rough or smooth (see Fig. 199) . . . . → *41*

39a. Second anal-fin spine 2.1 to 2.3 times in head length; longest dorsal-fin spine 2.5 to 2.7 times in head length; dorsal-fin rays 15 or 16; polygonal dark spots on body separated mainly by white dots at corners of spots; yellow-brown blotch behind eye, sometimes linked to similar horizontally elongate spot on opercle (Fig. 196, Plate XV) (Mozambique to west-central Pacific) . . . . ***E. hexagonatus***

39b. Second anal-fin spine 2.4 to 3.6 times in head length; longest dorsal-fin spine 2.8 to 3.8 times in head length; dorsal-fin rays 14 to 16; dark spots on body fully separated by a network of pale lines; no yellow-brown blotch behind eye or on opercle . . . . → *40*

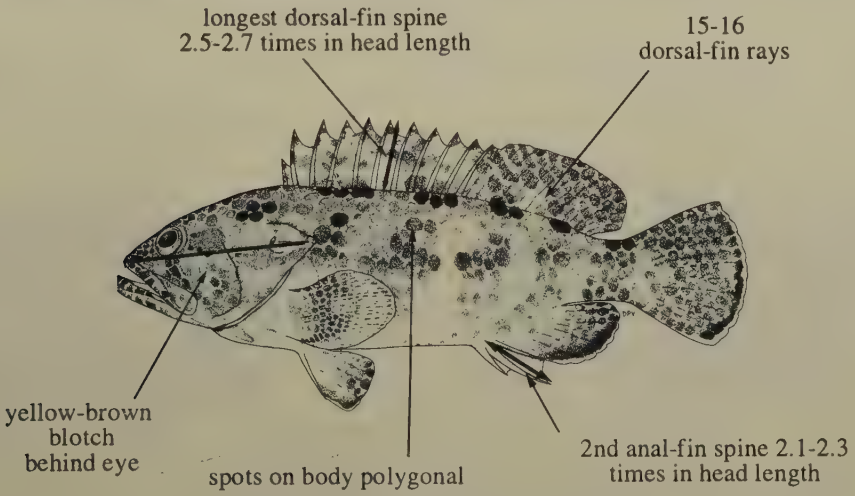

longest dorsal-fin spine 2.5-2.7 times in head length
15-16 dorsal-fin rays
yellow-brown blotch behind eye
spots on body polygonal
2nd anal-fin spine 2.1-2.3 times in head length

Fig. 196 ***Epinephelus hexagonatus***

40a. A single black blotch on body at base of posterior dorsal-fin spines and extending onto fin about halfway to margin; dark spots at front of upper lip in 1 or 2 irregular horizontal rows; caudal-peduncle depth 3.2 to 3.7 times in head length (South Africa to central Pacific) (Fig. 197, Plate XVIII) . . . . ***E. melanostigma***

40b. Three or 4 black blotches (or groups of spots darker than others) at base of dorsal fin, and 1 on top of peduncle; blotch at base of last few dorsal-fin spines not extending halfway to fin margin; small dark spots in 3 or 4 irregular rows along front of upper lip; caudal-peduncle depth 3.7 to 4.3 times in head length (Fig. 198, Plate XXII) (South Africa to central Pacific) . . . . ***E. spilotoceps***

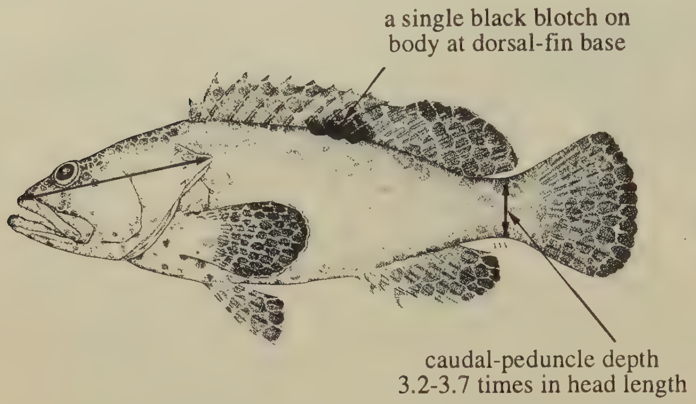

a single black blotch on body at dorsal-fin base
caudal-peduncle depth 3.2-3.7 times in head length

Fig. 197 ***Epinephelus melanostigma***

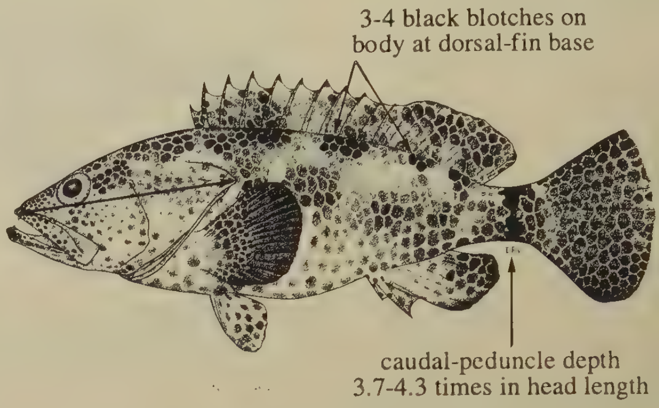

3-4 black blotches on body at dorsal-fin base
caudal-peduncle depth 3.7-4.3 times in head length

Fig. 198 ***Epinephelus spilotoceps***

41a. Dorsal-fin rays 13 to 15; total gill rakers 29 to 31; lateral-line scales 53 to 58; body depth 2.6 to 2.9 times in standard length; head and body pale yellowish brown, with irregular dark brown blotches and numerous small close-set dark brown spots; black saddle spot on caudal peduncle; midlateral-body scales of adults smooth (Fig. 199, Plate XIV) (Indo-Pacific) . . . . ***E. fuscoguttatus***

41b. Dorsal-fin rays usually 15 or 16; total gill rakers 22 to 29; lateral-line scales 53 to 74; body depth 2.7 to 3.7 times in standard length; colour not as in 41a; midlateral-body scales rough (except large ***E. andersoni*** and ***E. tauvina*** which have mainly smooth scales) . . . . → *42*

42a. Irregular black spots (less than half pupil size) on head, body, dorsal fin, and a few on caudal fin; most spots on head arranged in rows radiating from eye; no spots on ventral parts of head or body or on anal and paired fins; no auxiliary scales; maxilla not reaching past vertical at rear edge of eye (Fig. 200, Plate XVII) (South Africa to New Caledonia, in deep water) . . . . ***E. magniscuttis***

42b. Colour not as in 42a; auxiliary scales present on body of adults; maxilla usually reaching past vertical at rear edge of eye . . . . → *43*

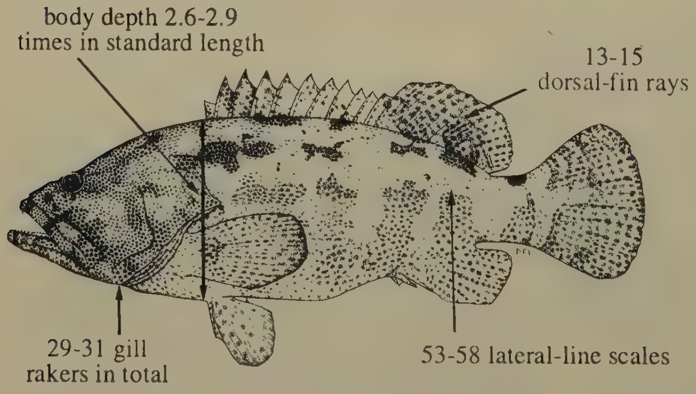

body depth 2.6-2.9 times in standard length
13-15 dorsal-fin rays
29-31 gill rakers in total
53-58 lateral-line scales

Fig. 199 ***Epinephelus fuscoguttatus***

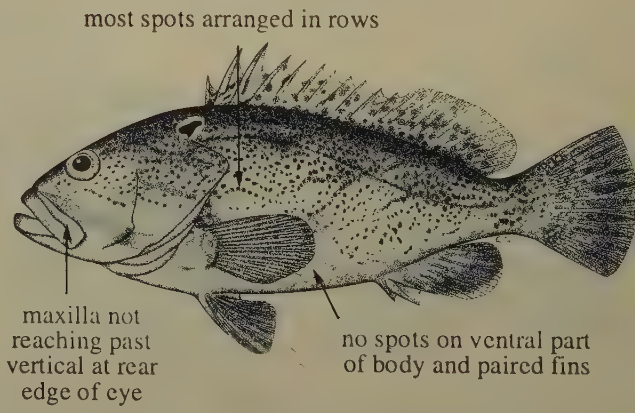

most spots arranged in rows
maxilla not reaching past vertical at rear edge of eye
no spots on ventral part of body and paired fins

Fig. 200 ***Epinephelus magniscuttis***

43a. Dorsal-fin rays 15 to 17; posterior nostrils (at standard length greater than 14 cm) vertically elongate, their length 2 or 3 times diameter of anterior nostrils; pectoral-fin length 1.5 to 1.7 times in head length; lateral-scale series 88 to 109; grey, with well separated black spots smaller than pupil on head, body, and fins; 3 dusky to blackish blotches on body at base of rear half of dorsal fin, the largest at base of last 2 or 3 spines; dusky to blackish saddle spot on caudal peduncle; juveniles with black-edged white spots on head and body (Fig. 201, Plate X) (Western Australia and western Pacific) . . . . ***E. corallicola***

43b. Dorsal-fin rays 13 to 16; nostrils subequal or posterior nostrils enlarged, but not vertically elongate or more than twice diameter of anterior nostrils; pectoral-fin length 1.6 to 2.5 times in head length; lateral-scale series 95 to 130; colour not as in 43a . . . . → *44*

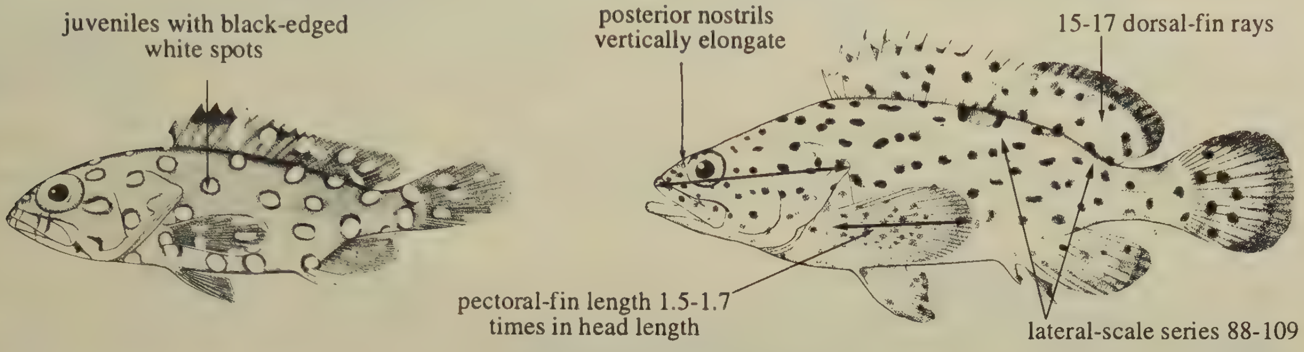

juveniles with black-edged white spots
posterior nostrils vertically elongate
15-17 dorsal-fin rays
pectoral-fin length 1.5-1.7 times in head length
lateral-scale series 88-109

Fig. 201 ***Epinephelus corallicola***

44a. Lateral-line scales 54 to 65, the anterior scales of large adults with branched tubules; numerous small bony platelets on side of first gill arch; body with 5 irregular dark bars which tend to bifurcate ventrally (bars may be faint or broken into series of 2 or 3 large blotches) . . . → *45*

44b. Lateral-line scales 62 to 74, none with branched tubules; no small bony platelets on side of first gill arch; dark bars not present on body (or only faintly on ***E. tauvina***) . . . . → *46*

45a. Head and body with numerous small well-separated black spots (largest spots about twice size of rear nostrils); irregular white or pale spots or blotches usually present on head and body; pectoral-fin rays modally 19 (Fig. 202, Plate XVIII) (Indo-Pacific) . . . . ***E. malabaricus***

45b. Head, body, and usually median fins with numerous orange, brownish orange, or reddish brown spots (diameter of largest spots about 4 or 5 times that of rear nostrils); no white or pale spots on head or body; orange spots become poorly defined and darker with growth; spots on head often coalesce and become elongate, arranged in irregular rows radiating from eye; fins brownish, with proximal parts brown spotted; orange spots turn brown after death and are poorly defined on preserved specimens; pectoral-fin rays modally 20 (Fig. 203, Plate X) (Indo-Pacific). . . . . ***E. coioides***

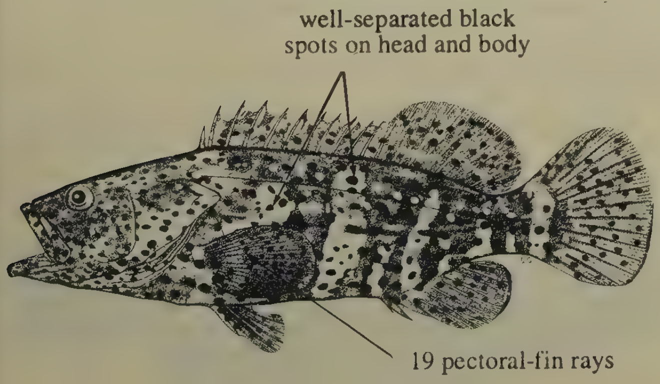

well-separated black spots on head and body
19 pectoral-fin rays

Fig. 202 ***Epinephelus malabaricus***

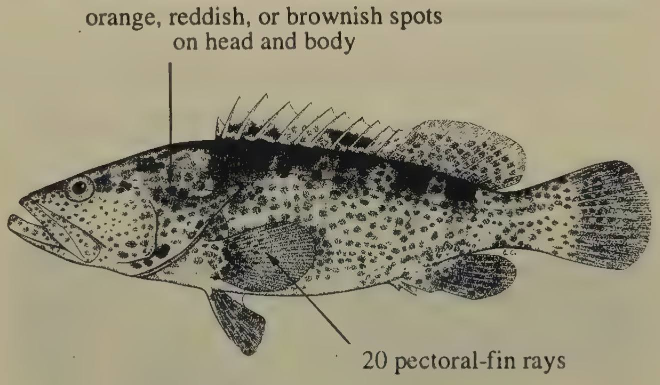

orange, reddish, or brownish spots on head and body
20 pectoral-fin rays

Fig. 203 ***Epinephelus coioides***

46a. Head, body, and fins greyish brown; numerous round to irregular dark brown spots on body, dorsal fin, and upper part of caudal fin; 2 dark streaks run posteriorly from lower half of eye and a third dark streak runs posteriorly from maxillary streak; 3 to 7 greatly enlarged serrae at corner of preopercle (Fig. 204); 2 or 3 rows of teeth on midside of lower jaw (Fig. 205, Plate VIII) (southern Mozambique to South Africa) . . . . *E. andersoni*

46b. Colour not as in 46a; serrae at corner of preopercle slightly to moderately enlarged (Fig. 204); 3 to 6 rows of teeth on midside of lower jaw of adults . . . . → *47*

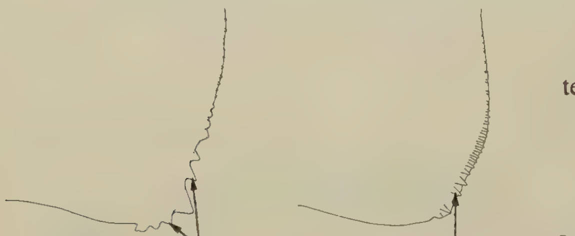

3-7 greatly enlarged serrae at preopercle corner
serrae at corner of preopercle slightly enlarged

Fig. 204

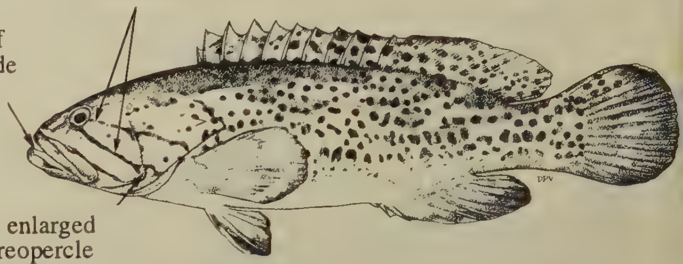

3 dark streaks on head
2 or 3 rows of teeth on midside of lower jaw
3-7 greatly enlarged serrae at preopercle corner

Fig. 205 ***Epinephelus andersoni***

47a. Body with several large round or oval dark brown blotches, arranged in 5 or 6 subvertical series; head and fins with smaller dark brown spots and irregular dark streaks; lateral-scale series 113 to 130; maximum length at least 150 cm (Fig. 206, Plate XXIV) (Indo-Pacific). *E. tukula*

47b. Colour not as in 47a; lateral-scale series 95 to 112; maximum length about 80 cm . . . . → *48*

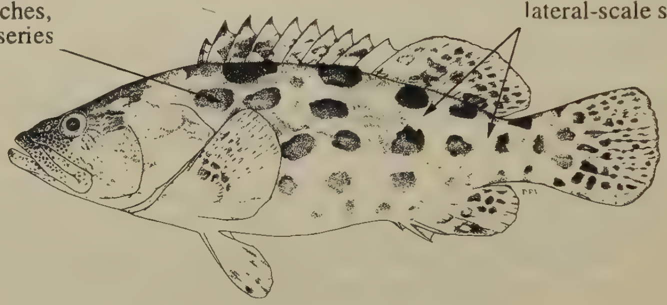

body with large blotches, arranged in vertical series
lateral-scale series 113-130

Fig. 206 ***Epinephelus tukula***

48a. Head length 2.1 to 2.4 times in standard length; head, body, and fins with orange-red to dark brown spots (those on body nearly as large as eye in young, about pupil size in large fish; spots usually absent in outer part of pectoral fins of adults); body often with faint oblique dark bars; blackish blotch often present at base of last 4 dorsal-fin spines and extending into lower part of fin (more evident in young) (Fig. 207, Plate XXIII) (Indo-Pacific) . . . . *E. tauvina*

48b. Head length 2.4 to 2.7 times in standard length; head and body with dark brown to black spots much smaller than pupil, those posteriorly on body often coalescing to form irregular stripes; 4 blackish blotches often present at base of dorsal fin and 1 on caudal peduncle; caudal, dorsal and anal fins with small white spots and white margins (Fig. 208, Plate XXII) (Oceania) . . . *E. socialis*

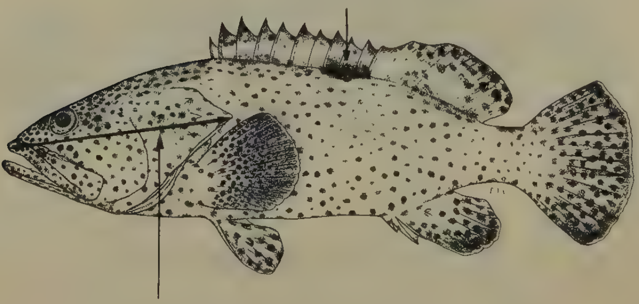

blackish blotch often present at base of last 4 dorsal-fin spines
head length 2.1-2.4 times in standard length

Fig. 207 ***Epinephelus tauvina***

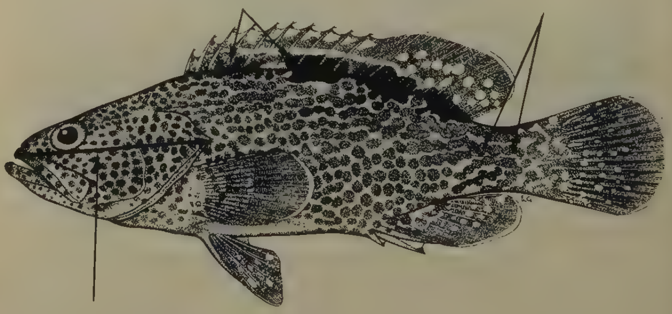

4 blackish blotches often present at base of dorsal fin
dark spots posteriorly on body often coalescing
head length 2.4-2.7 times in standard length

Fig. 208 ***Epinephelus socialis***

49a. Membranes of spinous dorsal fin usually not incised (some specimens with membranes slightly to moderately incised); head and body dark brown or greenish brown, marbled with irregular pale spots and blotches; 1 or 2 faint dark streaks running posteriorly from eye; no dark spots on head, body or fins (Fig. 209, Plate XIII) (Pakistan to Indonesia and Gulf of Thailand) . . . . *E. erythrurus*

49b. Interspinous dorsal-fin membranes moderately to deeply incised (Fig. 156); colour not as in 49a . . . . → *50*

50a. Body pale greyish brown, with 5 dark bars; a narrow pale bar may be present within dark bars, nearly dividing them in two; fins greyish, the median fins with several small dark spots; lower limb gill rakers 13 to 15 (Fig. 210, Plate XXII) (Viet Nam and Philippines to northern Australia). . . . . *E. sexfasciatus*

50b. Colour not as in 50a; lower gill rakers 14 to 19. . . . . → *51*

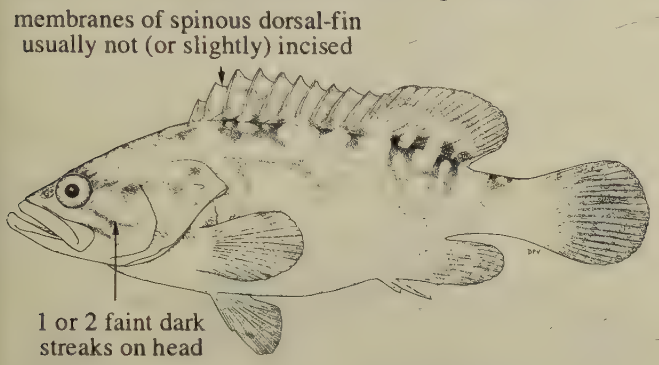

membranes of spinous dorsal-fin usually not (or slightly) incised
1 or 2 faint dark streaks on head

Fig. 209 ***Epinephelus erythrurus***

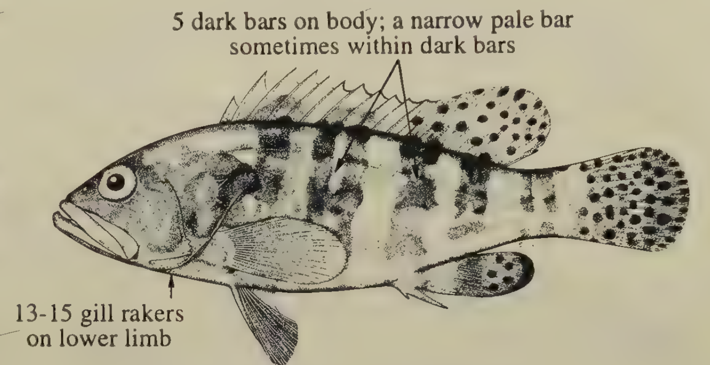

5 dark bars on body; a narrow pale bar sometimes within dark bars
13-15 gill rakers on lower limb

Fig. 210 ***Epinephelus sexfasciatus***

51a. Head, body, and median fins uniform dark grey; pectoral fins pale, pelvic fins blackish; body depth subequal to head length, contained 2.4 times in standard length; lateral-line scales 67 to 69; dorsal-fin rays 16 or 17 (Fig. 211) (Timor Sea off Western Australia) . . . . *E. trophis*

51b. Colour not as in 51a; body depth less than head length, 2.5 to 3.6 times in standard length; lateral-line scales 48 to 72; dorsal-fin rays 13 to 18 . . . . → *52*

52a. Body pale, with close-set brown or brownish orange wavy longitudinal to oblique stripes, the intervening pale lines forming a maze-like pattern; head greyish brown with numerous small close-set brownish orange spots; dorsal-fin rays 15 to 17; body depth 2.5 to 2.9 times in standard length; interorbital space convex (Fig. 212, Plate XXIV) (southern Queensland to South Australia). . . . . *E. undulatostriatus*

52b. Colour not as in 52a; dorsal-fin rays 13 to 18; body depth 2.6 to 3.6 times in standard length . . . → *53*

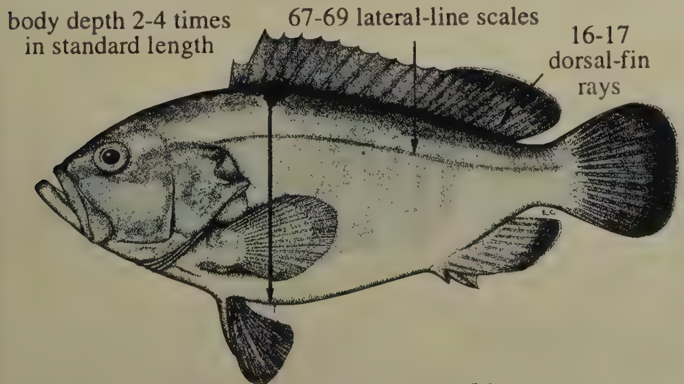

body depth 2-4 times in standard length
67-69 lateral-line scales
16-17 dorsal-fin rays

Fig. 211 ***Epinephelus trophis***

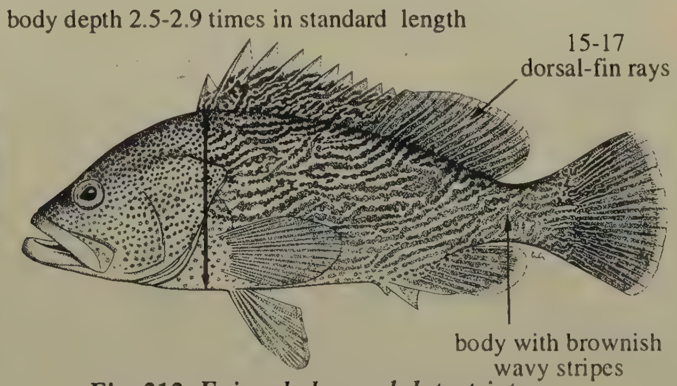

body depth 2.5-2.9 times in standard length
15-17 dorsal-fin rays
body with brownish wavy stripes

Fig. 212 ***Epinephelus undulatostriatus***

53a. Dorsal-fin rays 15 to 18 (rarely 15); body usually with vertical or slightly oblique broad dark bars (faint or absent on some species) . . . . → *54*

53b. Dorsal-fin rays 13 to 16 (rarely 16); body without dark vertical bars (except juvenile *E. bruneus* and *E. daemelii* which have dark oblique bars containing pale spots and streaks). . . → *64*

54a. Head, body, and fins pale greenish yellow; dark orange-brown to black dots (less than 2 mm in diameter) dorsally on head (behind eye) and body (anteriorly); soft dorsal and caudal fins with narrow dark brown margin; dark line along base of soft dorsal fin; lateral-line scales 48 to 51 (Fig. 213, Plate XXII) (southern Japan to northwestern Australia) . . . . ***E. stictus***

54b. No dark brown to black dots on body or head (some species with black spots, but these are larger than 2 mm); 48 to 75 lateral-line scales. . . . . → *55*

55a. Margin of interspinous dorsal-fin membranes black (red in fish from Western Australia and deep water); edge of orbit narrowly black, surrounded by a pale blue line; body usually with 5 faint dark bars often containing irregular pale spots (Fig. 214, Plate XIII) (Indo-Pacific) . . ***E. fasciatus***

55b. Margin of spinous dorsal fin not black; rim of orbit not black; dark bars on body present or absent. . . . . → *56*

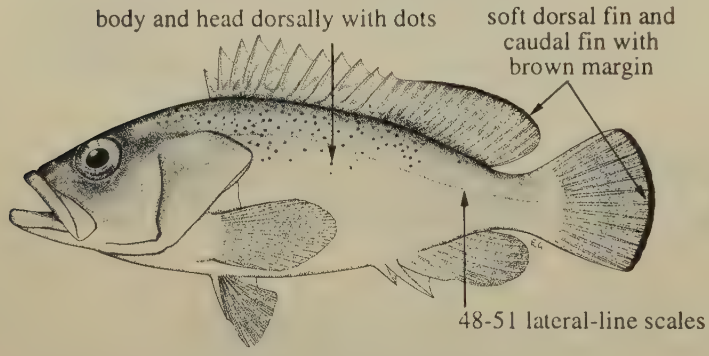

body and head dorsally with dots
soft dorsal fin and caudal fin with brown margin
48-51 lateral-line scales

Fig. 213 ***Epinephelus stictus***

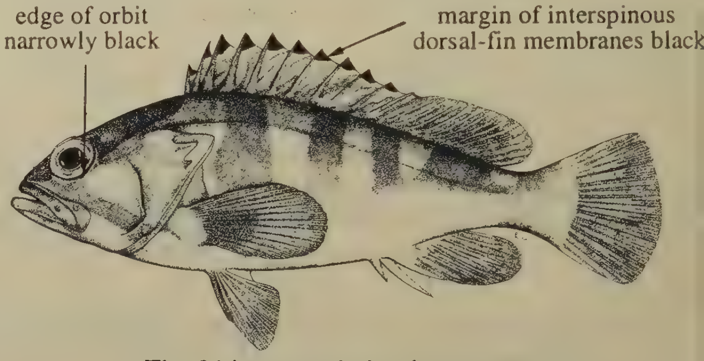

edge of orbit narrowly black
margin of interspinous dorsal-fin membranes black

Fig. 214 ***Epinephelus fasciatus***

56a. Nape and front of body above lateral line with minute cycloid scales and numerous pores; body scales with a whitish dot (may be lost in alcohol); semicircular dark red to reddish brown blotch at base of pectoral fin; dark pigment in crease along base of spinous dorsal fin; usually some violet lines and spots on cheek (Fig. 215, Plate XXII) (South Africa to Pacific). . . . . ***E. rivulatus***

56b. Nape and dorsoanterior part of body without minute scales and numerous pores; colour not as in 56a . . . . → *57*

57a. Corner of preopercle with 1 to 6 large spines (2 or 3 times longer than serrae above corner) (Fig. 216); dark bars on body vertical or nearly vertical . . . . → *59*

57b. Serrae at corner of preopercle only slightly to moderately enlarged (Fig. 216); dark bars on body oblique (may be faint or absent) . . . . → *58*

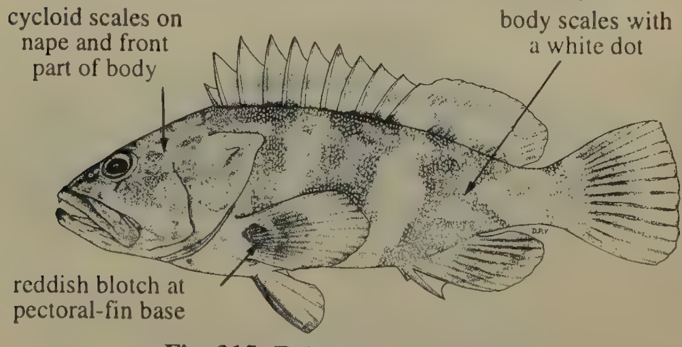

cycloid scales on nape and front part of body
body scales with a white dot
reddish blotch at pectoral-fin base

Fig. 215 ***Epinephelus rivulatus***

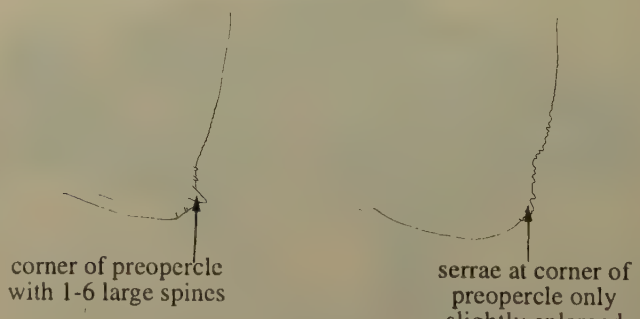

corner of preopercle with 1-6 large spines
serrae at corner of preopercle only slightly enlarged

Fig. 216

58a. Head length contained 2.1 to 2.4 times in standard length; adults with 4 dark brown bars on body and 1 on caudal peduncle; brown bands on head; small black spots on edges of brown bars and bands; no dark spots in fins; juveniles with black bars on body and scattered small black spots in fins; lower gill rakers 14 to 16 (Fig. 217, Plate VII) (Andaman Sea to western Pacific) . . . . *E. amblycephalus*

58b. Head length 2.3 to 2.6 times in standard length; 4 dark bars (sometimes faint or absent) on dorsal part of body; head and body with numerous small yellow spots (but no black spots); body and median fins also with greyish white spots; rear margin of median fins with a broad yellow border; lower gill rakers 16 to 18 (Fig. 218, Plate VIII) (Korea and southern Japan to South China Sea) . . . . *E. awoara*

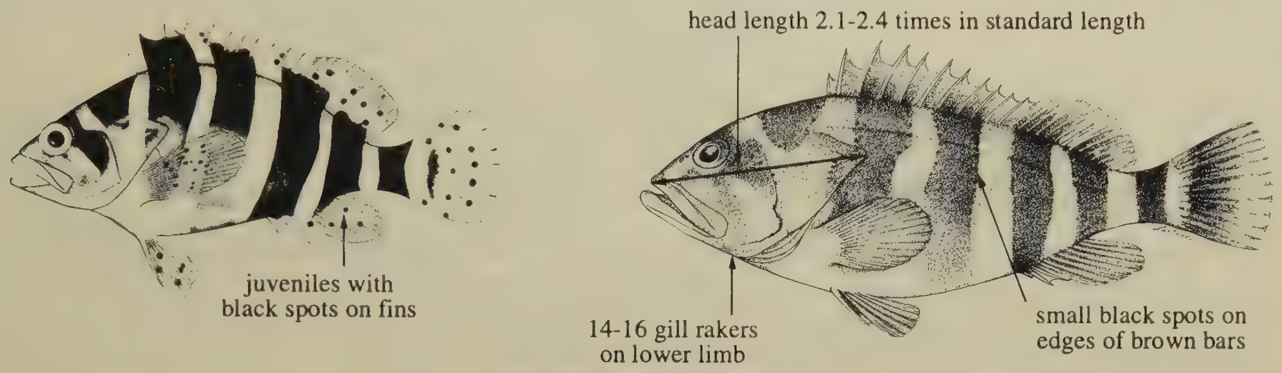

head length 2.1-2.4 times in standard length
juveniles with black spots on fins
14-16 gill rakers on lower limb
small black spots on edges of brown bars

Fig. 217 ***Epinephelus amblycephalus***

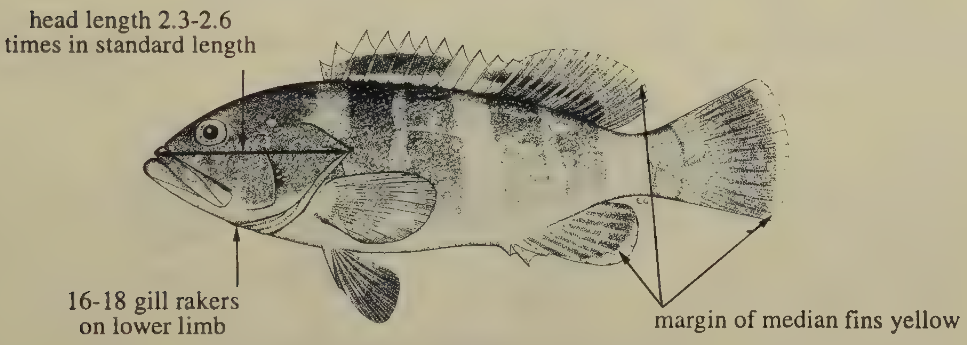

head length 2.3-2.6 times in standard length
16-18 gill rakers on lower limb
margin of median fins yellow

Fig. 218 ***Epinephelus awoara***

59a. Pelvic-fin length contained 2.3 to 2.5 times in head length, longest dorsal-fin spine 3.0 to 3.5 times in head length; pectoral-fin rays 18 to 20; lateral-line scales 52 to 59; no dark or light spots on head or body; no dark spots in fins (Fig. 219, Plate XII) (Gulf of Oman to Sri Lanka) . *E. diacanthus*

59b. Pelvic-fin length 1.7 to 2.3 times in head length, longest dorsal-fin spine 2.3 to 3.2 times in head length; pectoral-fin rays 17 to 19; lateral-line scales 46 to 55; body and/or fins with small spots . . . → *60*

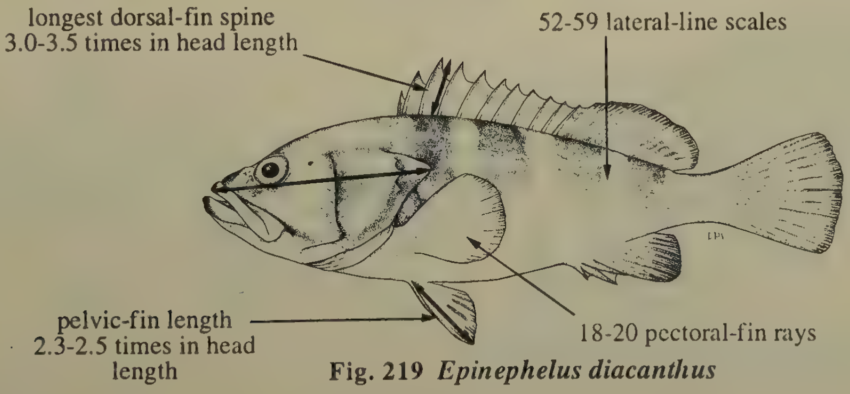

longest dorsal-fin spine 3.0-3.5 times in head length
52-59 lateral-line scales
pelvic-fin length 2.3-2.5 times in head length
18-20 pectoral-fin rays

Fig. 219 ***Epinephelus diacanthus***

60a. Head and body brownish grey, covered (except ventrally) with red, orange, or gold spots (pale in alcohol); dorsal-fin margin yellow or orange; dusky yellow or orange spots (one per membrane) along middle of spinous dorsal fin and another row along base of fin; black blotch at base of last 3 dorsal-fin spines (Fig. 220, Plate VII) (Japan, Korea, Taiwan, and China) . . . . *E. akaara*

60b. Colour not as in 60a . . . . → *61*

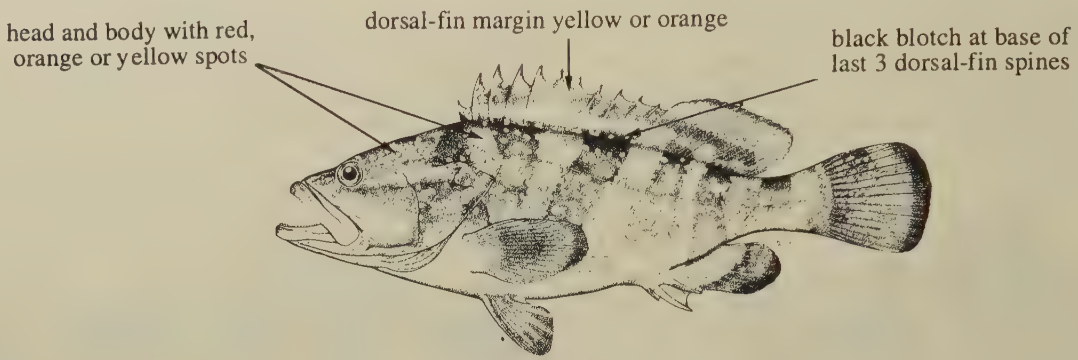

head and body with red, orange or yellow spots
dorsal-fin margin yellow or orange
black blotch at base of last 3 dorsal-fin spines

Fig. 220 *Epinephelus akaara*

61a. Head and body with numerous small dark brown, brownish yellow or russet spots (dark in alcohol); 3-5 broad dark bars usually visible on body, the first 4 extend onto dorsal fin (first 2 bars darker dorsally, extending to margin of spinous dorsal fin), the last bar on caudal peduncle (Fig. 221, Plate XIII) (southern Japan to South China Sea). . . . . *E. fasciatomaculosus*

61b. Colour not as in 61a . . . . → *62*

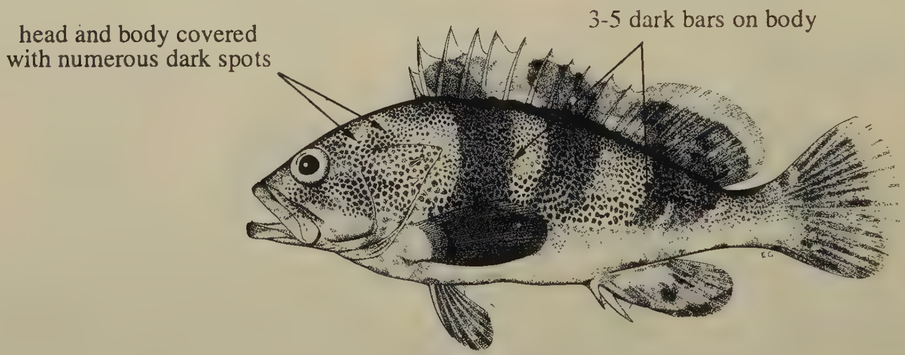

head and body covered with numerous dark spots
3-5 dark bars on body

Fig. 221 *Epinephelus fasciatomaculosus*

62a. Rear half of body with 4 dark bars, the last bar on peduncle; head and front part of body with dark orange-red or reddish brown spots; pectoral-fin base pale, with a dark oval blotch; chest pale, with dark bands; median fins with pale yellow margin (Fig. 222, Plate XXIII) (Red Sea to Pakistan) . . . . *E. stoliczkae*

62b. Colour not as in 62a . . . . → *63*

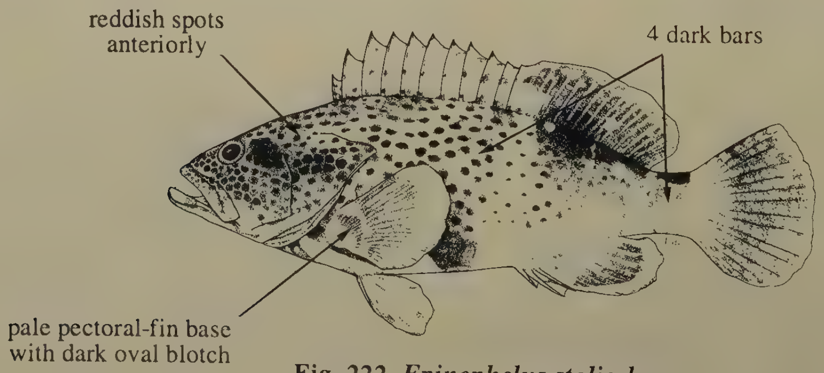

reddish spots anteriorly
4 dark bars
pale pectoral-fin base with dark oval blotch

Fig. 222 *Epinephelus stoliczkae*

63a. Head, body, and dorsal fin dark brownish grey, with numerous small white spots and blotches; on adults (larger than 30 cm standard length) most white spots on the body are coalesced, forming wavy pale lines and mottlings; a few dark blotches usually visible on body at base of dorsal fin; midlateral part of lower jaw with 3 to 5 rows of small teeth (Fig. 223, Plate X) (South Africa to western Pacific) . . . . *E. caeruleopunctatus*

63b. Body with 7 or 8 alternating stripes of greenish brown and yellow-orange; dorsal part of head and snout dark green; cheek pale green (colour from Valenciennes, 1830); midlateral part of lower jaw with 2 rows of teeth; dorsal-fin rays 17; body depth 3.4 times in standard length; lateral-line scales 52 to 54; 8 gill rakers on upper limb and 15 gill rakers on lower limb (Fig. 224) (1 specimen, 17 cm standard length, Tonga Islands) . . . . *E. chlorocephalus*

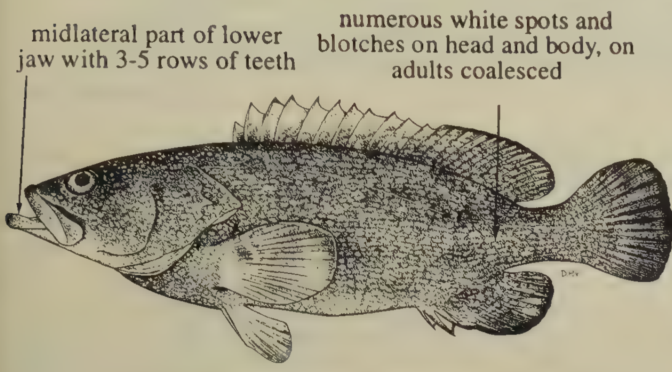

midlateral part of lower jaw with 3-5 rows of teeth
numerous white spots and blotches on head and body, on adults coalesced

Fig. 223 *Epinephelus caeruleopunctatus*

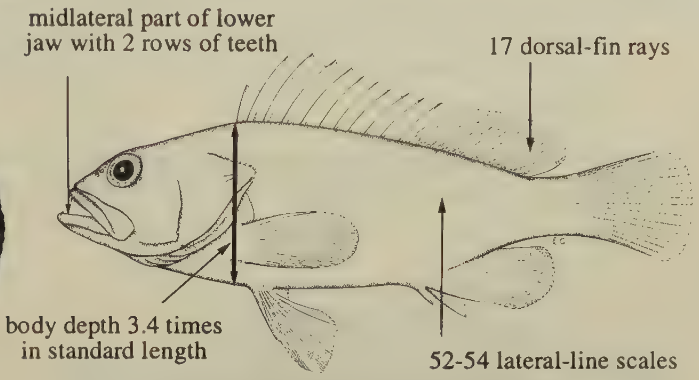

midlateral part of lower jaw with 2 rows of teeth
17 dorsal-fin rays
body depth 3.4 times in standard length
52-54 lateral-line scales

Fig. 224 *Epinephelus chlorocephalus*

64a. Body of juveniles with oblique dark bars and pale spots; body elongate, the depth distinctly less than head length, 2.9 to 3.6 times in standard length; lateral-line scales 63 to 72 . . . . . → *65*

64b. No dark bars on juveniles or adults; body depth 2.6 to 3.2 times in standard length; lateral-line scales 48 to 72 . . . . → *66*

65a. A black saddle-blotch on caudal peduncle; numerous small white spots on head and body; body scales smooth (except area covered by pectoral fins), with auxiliary scales; large adults often uniformly dark brown or black, the underside of head pale (Fig. 225, Plate XI) (southeast Australia, Lord Howe Island, Norfolk Island, New Zealand, and Kermadec Islands) . . . . *E. daemelii*

65b. No black saddle-blotch on peduncle; white streaks and dark bands radiating from eye, but no small white spots on head and body (moderately large pale blotches may be present, especially within dark body bars); midlateral-body scales rough, without auxiliary scales; adults (larger than 40 cm standard length) dark greyish brown, the bars and bands replaced by faint dorsal blotches or absent altogether, the body covered with small pale grey spots forming short horizontal lines and a mottled pattern (Fig. 226, Plate IX) (Japan and Korea to Taiwan and Hainan) . . . . *E. bruneus*

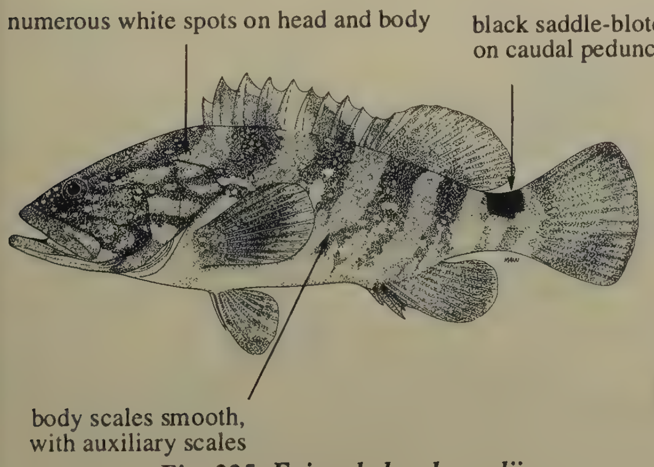

numerous white spots on head and body
black saddle-blotch on caudal peduncle
body scales smooth, with auxiliary scales

Fig. 225 *Epinephelus daemelii*

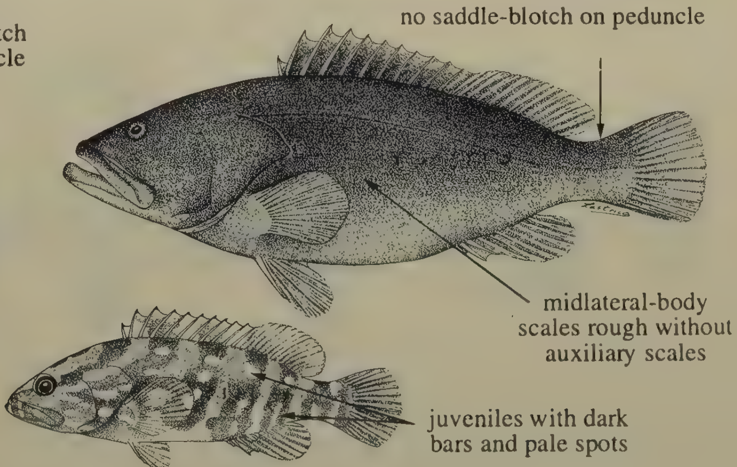

no saddle-blotch on peduncle
midlateral-body scales rough without auxiliary scales
juveniles with dark bars and pale spots

Fig. 226 *Epinephelus bruneus*

66a. Midlateral-body scales smooth (except for area covered by pectoral fins); body depth contained 3.15 times in standard length; body width 1.5 times in body depth; numerous small bony platelets on side of first gill arch (Fig. 227) (1 specimen, 67 cm standard length, Somalia) . . . . ***E. indistinctus***

66b. Midlateral-body scales rough (except large adults of ***E. marginatus*** with smooth scales); body depth contained 2.6 to 3.2 times in standard length; body width 1.7 to 2.5 times in body depth; no bony platelets on first gill arch . . . . → *67*

67a. Third anal-fin spine 15% longer than second spine; lateral-scale series 122; pectoral-fin rays 19; head and body greyish brown with a bluish cast ventrally; no dark or light markings (Fig. 228) (1 specimen, 95 cm standard length, Minami-Koho Seamount on Kyushu-Palau Ridge). . . . . ***E. suborbitalis***

67b. Third anal-fin spine less than 10% longer than second spine; lateral-scale series 81-125; pectoral-fin rays 15-18; obvious dark or light markings present on head and/or body. . . . . . → *68*

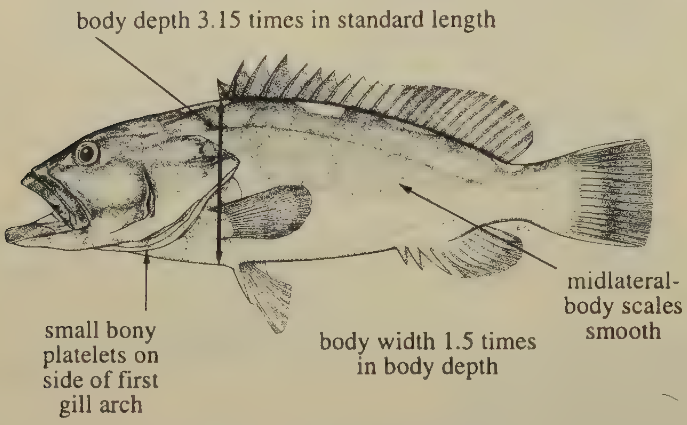

body depth 3.15 times in standard length
small bony platelets on side of first gill arch
body width 1.5 times in body depth
midlateral-body scales smooth

Fig. 227 ***Epinephelus indistinctus***

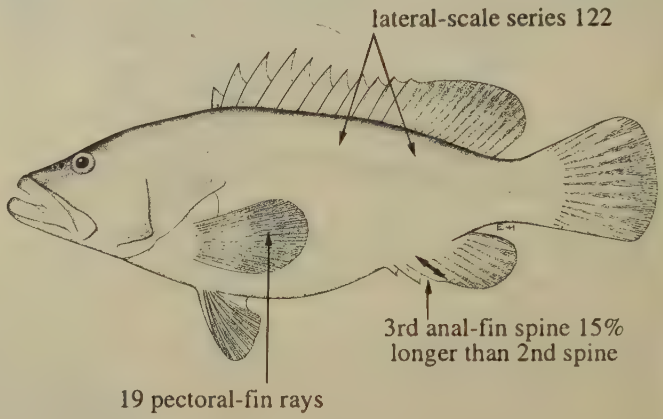

lateral-scale series 122
3rd anal-fin spine 15% longer than 2nd spine
19 pectoral-fin rays

Fig. 228 ***Epinephelus suborbitalis***

68a. Lateral-line scales 62 to 72; colour generally dark reddish brown or brownish grey, usually with irregular pale blotches of variable size on head and body; ventral parts of head and body usually yellowish; posterior margin of anal, caudal, and pectoral fins usually with a narrow white edge; longest dorsal-fin spine 2.3 to 2.8 times in head length (Fig. 229, Plate XVIII) (southern Mozambique to South Africa; subtropical and warm temperate Atlantic and Mediterranean) . . . . ***E. marginatus***

68b. Lateral-line scales 48 to 66; colour not as in 68a; longest dorsal-fin spine 2.5 to 3.8 times in head length. . . . . → *69*

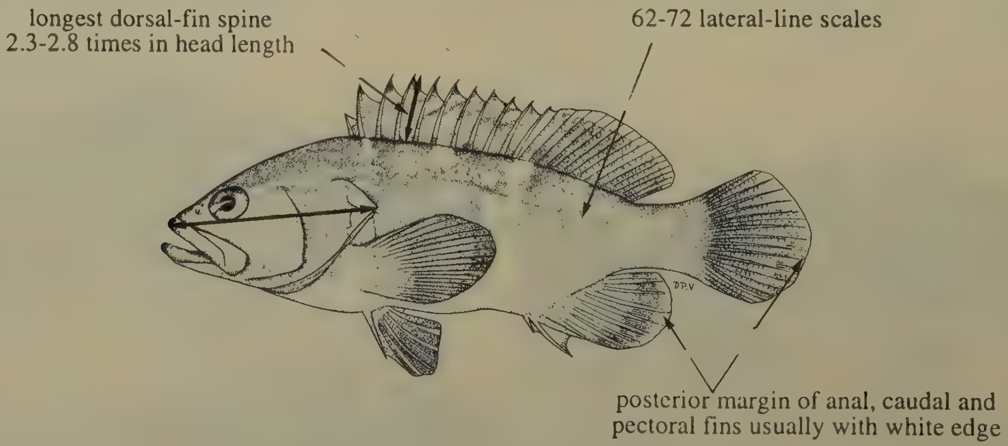

longest dorsal-fin spine 2.3-2.8 times in head length
62-72 lateral-line scales
posterior margin of anal, caudal and pectoral fins usually with white edge

Fig. 229 ***Epinephelus marginatus***

69a. Serrae at corner of preopercle slightly to moderately enlarged (Fig. 230); midlateral part of lower jaw with 3 to 5 rows of teeth in adults; lateral-line scales 48 to 55; body with auxiliary scales; colour pattern of white dots, spots, or blotches; shallow water species . . . . → *70*

69b. Preopercle corner with 2 to 5 large spines (Fig. 230); midside of lower jaw with 2 rows of teeth in adults; lateral-line scales 52 to 66; no auxiliary scales on body; colour pattern dominated by dark bands and/or series of dark spots . . . . → *72*

70a. Lateral-scale series 81 to 91; snout length 4.8 to 5.2 times in head length; head, body, and fins dark brown with numerous whitish dots (may not persist in preservative); posterior margins of median and pectoral fins narrowly orange-red (Fig. 231, Plate XXI) (Indonesia, Philippines, Papua New Guinea, New Ireland, and Solomon Islands in fresh and brackish water) . . . . *E. polystigma*

70b. Lateral-scale series 95 to 110; snout length 4.0 to 4.8 times in head length; head, body, and fins dark grey-brown with numerous small whitish spots and scattered large whitish blotches; maxillary streak black. . . . . → *71*

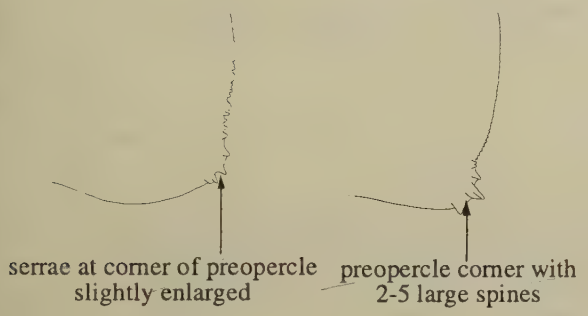

serrae at corner of preopercle slightly enlarged
preopercle corner with 2-5 large spines

Fig. 230

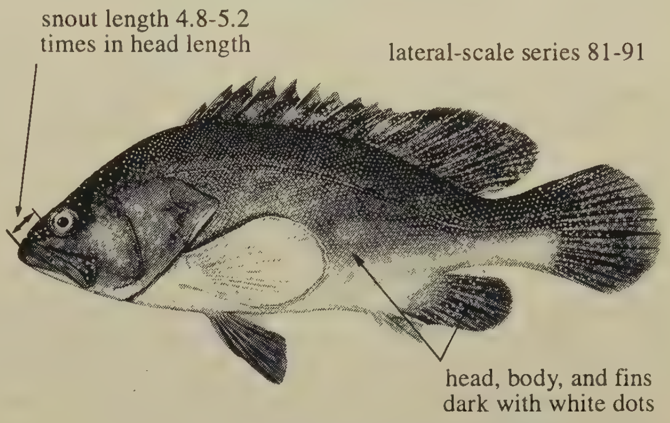

snout length 4.8-5.2 times in head length
lateral-scale series 81-91
head, body, and fins dark with white dots

Fig. 231 ***Epinephelus polystigma***

71a. Pectoral-fin rays 15 to 17; nostrils subequal; pectoral-fin length 1.3 to 1.7 times in head length; small whitish spots on adults tend to coalesce to form irregular longitudinal bands; paired fins of adults without whitish spots (Fig. 232, Plate XX) (Mozambique to western Pacific) . . . . *E. ongus*

71b. Pectoral-fin rays 16 to 18; rear nostrils of adults vertically ovate, its length 2 to 4 times diameter of anterior nostrils; pectoral-fin length 1.7 to 2.1 times in head length; whitish spots on body of adults not joining to form bands; paired fins with small whitish spots (Fig. 233, Plate XXIII) (Red Sea and Gulf of Aden). . . . . *E. summana*

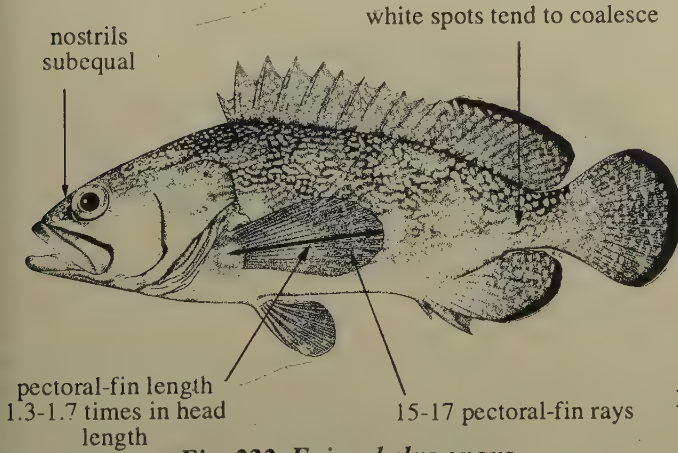

nostrils subequal
white spots tend to coalesce
pectoral-fin length 1.3-1.7 times in head length
15-17 pectoral-fin rays

Fig. 232 ***Epinephelus ongus***

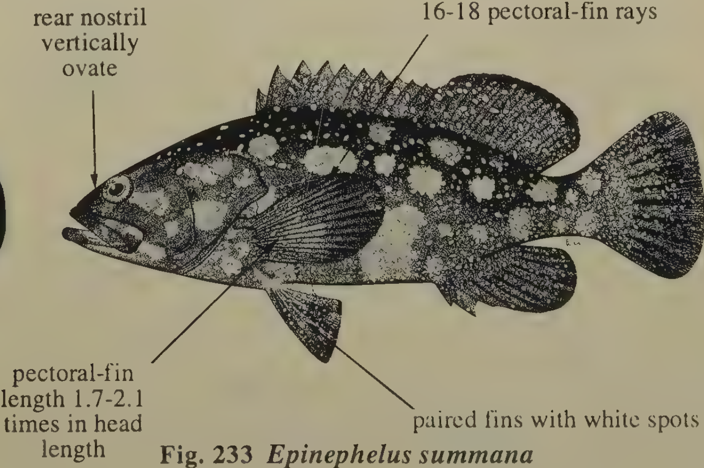

rear nostril vertically ovate
16-18 pectoral-fin rays
pectoral-fin length 1.7-2.1 times in head length
paired fins with white spots

Fig. 233 ***Epinephelus summana***

72a. Lateral-scale series 89 to 100; total gill rakers 21 to 25; no dark or light markings on body; yellowish brown stripe from eye to opercular flap and 2 similar bands on cheek, the lower runs posteriorly from end of maxilla (Fig. 234, Plate XV) (Indonesia, Philippines, Gulf of Thailand, Viet Nam, northern Australia, and New Britain, possibly to southern Japan). . ***E. heniochus***

72b. Lateral-scale series 102 to 125; total gill rakers 23 to 28; body with prominent dark brown bands and/or spots. . . . . → *73*

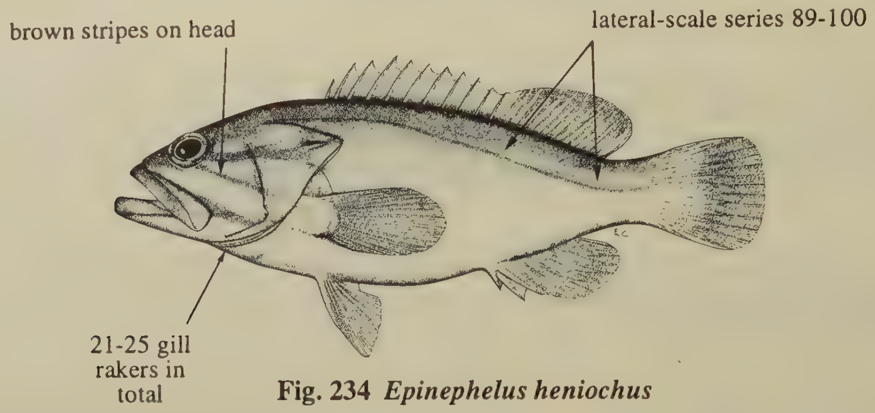

brown stripes on head
lateral-scale series 89-100
21-25 gill rakers in total

Fig. 234 ***Epinephelus heniochus***

73a. Body with long curved dark brown bands or series of spots, the middle of each band or row of spots more ventral than the ends (see Figs 235 and 236) . . . . → *74*

73b. Dark markings not as in 73a . . . . → *75*

74a. Large oval dark brown blotch (or group of small spots on larger fish) on body at base of middle dorsal-fin spines, this blotch not joined to lower dark bands; broadly-curved dark bands or rows of spots on head and body paralleling curvature of isolated dark blotch; dark markings faint or absent on large adults (Fig. 235, Plate XX) (South Africa to western Pacific) . . . . ***E. poecilonotus***

74b. Dark brown blotch on body at base of middle dorsal-fin spines joined to dark brown band passing to upper edge of gill opening; a second dark band from upper end of gill opening, bifurcating above pectoral fin, with branches to anterior and posterior dorsal-fin rays; 2 bands from eye, the upper branch to nape, the lower a broad curve or broken line to upper part of caudal peduncle (Fig. 236, Plate XIX) (Red Sea to South Africa and central Pacific) . . . . ***E. morrhua***

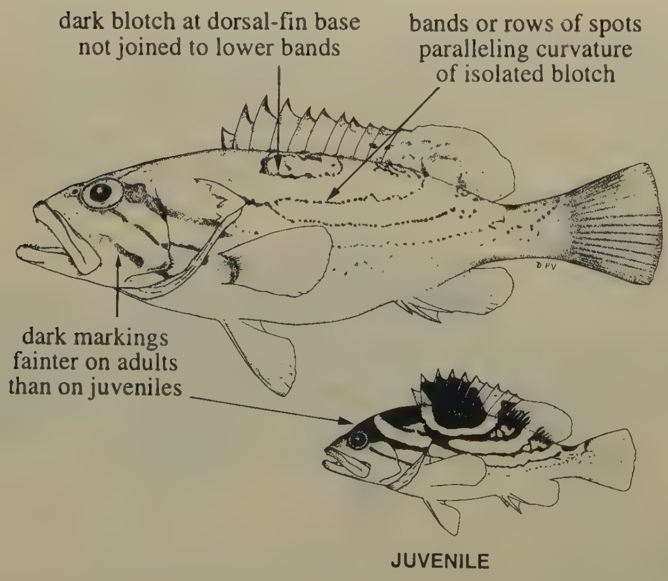

dark blotch at dorsal-fin base not joined to lower bands
bands or rows of spots paralleling curvature of isolated blotch
dark markings fainter on adults than on juveniles
JUVENILE

Fig. 235 ***Epinephelus poecilonotus***

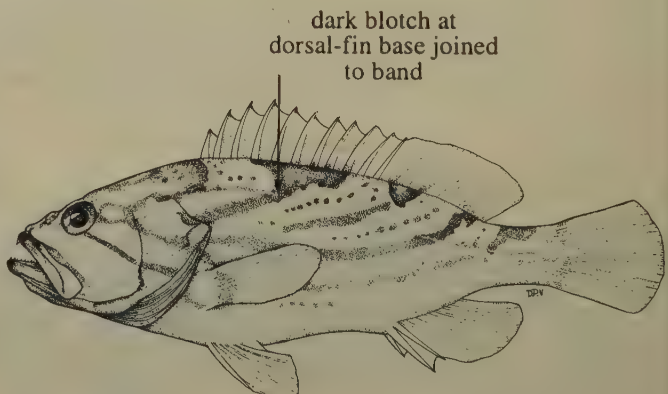

dark blotch at dorsal-fin base joined to band

Fig. 236 ***Epinephelus morrhua***

75a. Five irregular dark brown bands (with age only the edges remain dark) passing downward and forward from upper edge of body, the first from nape to eye, the second band from middle dorsal-fin spines to upper end of gill opening, third and fourth bands from soft dorsal-fin rays, branching as they pass ventrally, the fifth band on caudal peduncle (Fig. 237, Plate XXI) (Red Sea and islands of western Indian Ocean to western Pacific) . . . ***E. radiatus***

75b. Dark bands on postorbital head and body forming a coarse reticulum, none passing diagonally to ventral part of body (Fig. 238, Plate XXIV) (French Polynesia and Pitcairn Group) . . . . ***E. tuamotuensis***

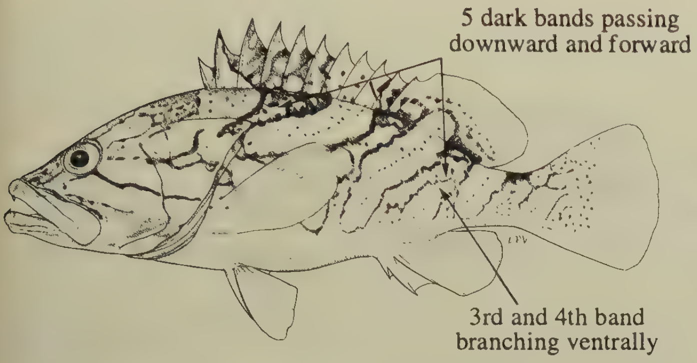

5 dark bands passing downward and forward
3rd and 4th band branching ventrally

Fig. 237 ***Epinephelus radiatus***

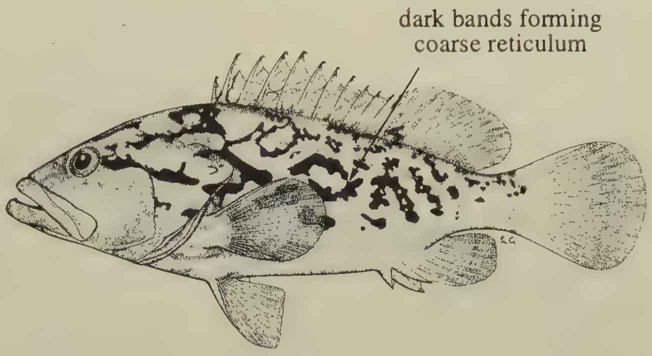

dark bands forming coarse reticulum

Fig. 238 ***Epinephelus tuamotuensis***

Epinephelus acanthistius (Gilbert, 1892)

Fig. 239; Pl. VIIA

SERRAN Epin 59

Bodianus acanthistius Gilbert, 1892:552 (type locality: Cape Lobos, Gulf of California).

Synonyms: *Cephalopholis popino* Walford, 1936:3 (type locality: Mazatlan, Mexico). ***Cephalopholis acanthistius***.

FAO Names: En - Rooster hind; **Fr** - Merou coq; **Sp** - Baqueta.

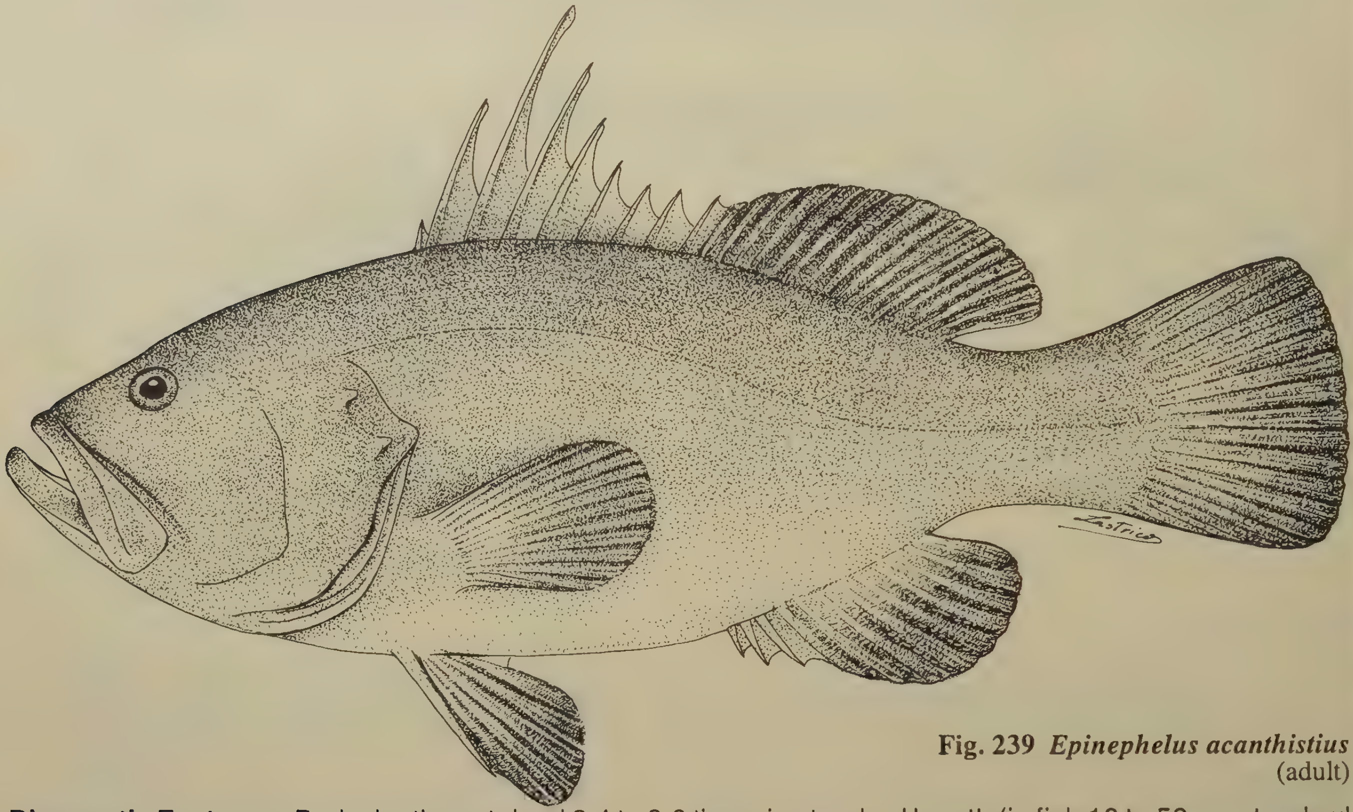


Fig. 239 ***Epinephelus acanthistius*** (adult)

Diagnostic Features: Body depth contained 2.4 to 2.6 times in standard length (in fish 10 to 50 cm standard length). Head length contained 2.3 to 2.4 times in standard length; interorbital area convex; preopercle rounded, finely serrate, the serrae at the angle enlarged but covered by skin; upper edge of operculum distinctly convex. Gill rakers 10 or 11 on upper limb and 14 to 17 on lower limb, total 25 to 27. Dorsal fin with IX spines and 17 rays; adults with second to fourth dorsal-fin spines greatly elongated and the interspinous membranes deeply incised; anal fin with III spines (the third longest) and 9 rays; pectoral-fin rays 18 or 19; pelvic-fin origin in front of lower end of pectoral-fin base; pelvic fins shorter than pectoral fins; caudal fin rounded. Midlateral-body scales ctenoid; distal parts of soft dorsal, anal, and caudal fins without scales; lateral-line scales 61 to 64; lateral-scale series 93 to 98. **Colour**: Head and body dark red or brown; pectoral fins darker than body; tips of interspinous dorsal-fin membranes darker than rest of membranes; naked distal portion of soft dorsal, anal, and caudal fins darker than proximal (scaly) parts of these fins; prominent black moustache streak above maxilla.

Geographical Distribution: Southern California to Peru (Fig. 240).

Habitat and Biology: *E. acanthistius* is a common species in the Gulf of California. Although occasionally caught close to shore, it is usually found in depths of 46 to 90 m (Thomson et al., 1979).

Size: Attains at least 100 cm total length.

Interest to Fisheries: This species is of some importance in the local fisheries of the Gulf of California. Caught in trawls or with hook-and-line.

Local Names: USA: Gulf coney.

Literature: Walford (1937); Smith (1971); Thomson et al. (1979).

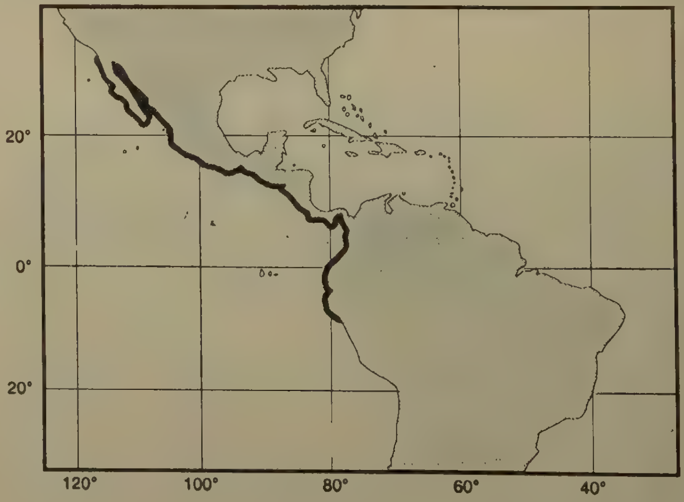


Fig. 240

Remarks: *E. acanthistius* is unique among the species of *Epinephelus* in having only IX dorsal-fin spines. Jordan and Evermann (1896) proposed the monotypic subgenus *Enneistus* for this fish, and Jordan et al. (1930) elevated this taxon to a genus. Although it has only IX dorsal-fin spines, this species has bisegmental pterygiophores in the dorsal and anal-fin supports, as is typical for species of *Epinephelus*; it also lacks the knob at the lower rear corner of the maxilla that is seen in adults of *Cephalopholis*. And it is similar to species of the *E. niveatus* species-complex in having the origin of the pelvic fins located in front of the pectoral-fin base and in having large dark-coloured pelvic fins. According to the biochemical data presented by Lopez Lemus (1988), *E. acanthistius* is quite distinct from *Cephalopholis panamensis* as well as *Epinephelus analogus* and *E. labriformis*.

Epinephelus adscensionis (Osbeck, 1765) Fig. 241; Pl. VIIB SERRAN Epin 13

Trachinus adscensionis Osbeck, 1765:388 (type locality: Ascension Island, Soutn Atlantic Ocean).

Synonyms: *Perca stellio* Walbaum, 1792:349 (based on *Perca tota maculis* Seba, 1758:76, pl. 27, fig. 7; type locality not given). *Trachinus osbeck* Lacepède, 1800:364 (substitute for *Trachinus adscensionis*; type locality: Ascension Island). *Serranus pixanga* Valenciennes in Cuv. and Val., 1828:383 (type locality: unknown [presumably Brazil]; based on a description by Marcgrave). *Serranus nigriceps* Valenciennes in Cuv. and Val., 1830:517 (type locality: unknown [*fide* Bauchot et al. 1984:*corrigendum*]). *Serranus impetiginosus* Müller and Troschel, 1848:665 (type locality: Barbados). *Serranus capreolus* Poey, 1860:145 (type locality: Cuba). *Serranus varius* Bocourt, 1868:222 (type locality: Gulf of Mexico).

FAO Names: **En** - Rock hind; **Fr** - Mérou oualioua; **Sp** - Mero cabrilla.

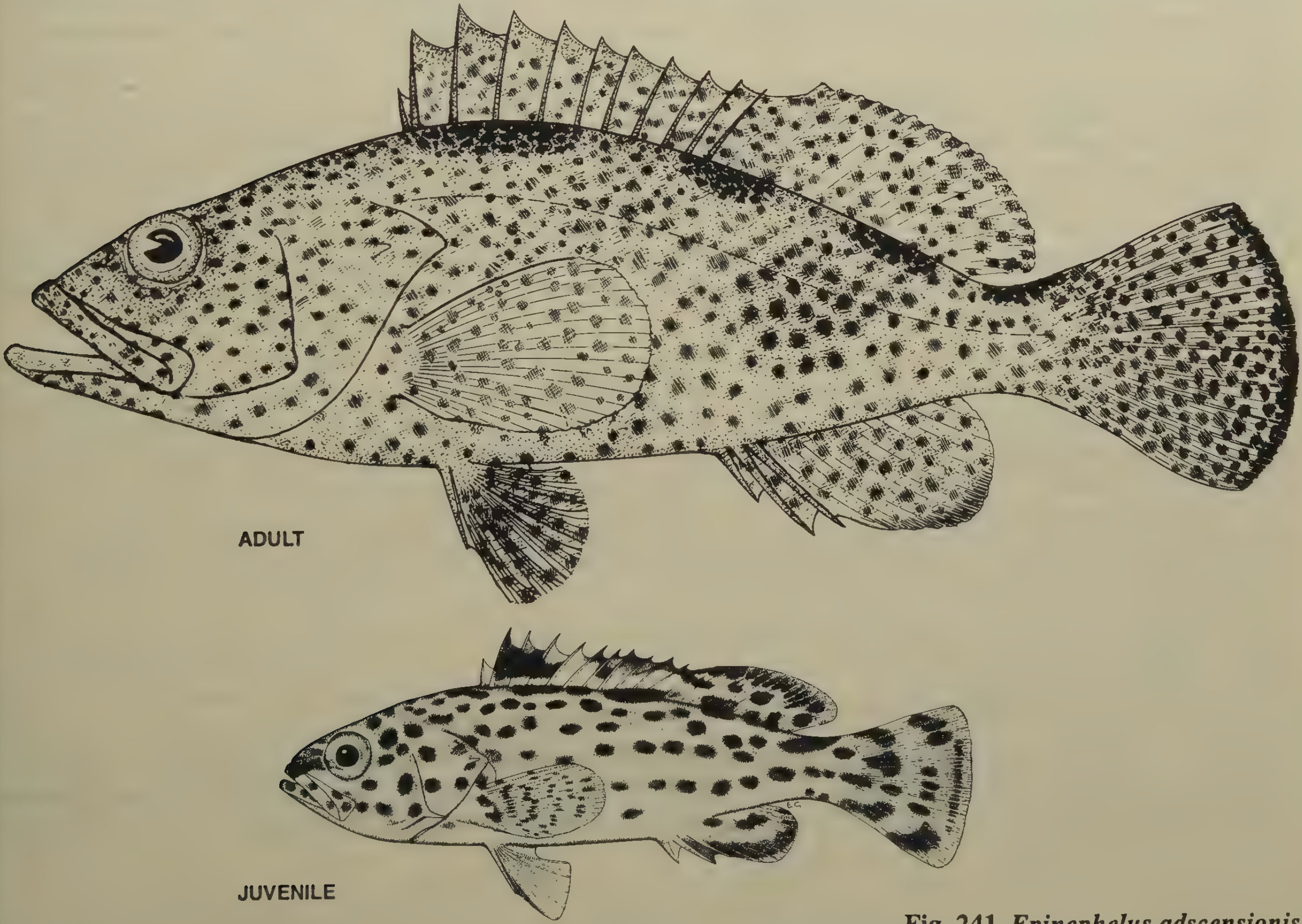


Fig. 241 *Epinephelus adscensionis*
(adult about 290 mm total length, juvenile 40 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.6 to 3.2 times in standard length (for fish 13 to 27 cm standard length). Head length contained 2.1 to 2.5 times in standard length; interorbital area flat or slightly concave; preopercle evenly serrate, without salient angle; subopercle and interopercle smooth; nostrils subequal. Gill rakers 7 to 9 on upper limb, 16 to 19 on lower limb, total 23 to 28. Dorsal fin with XI spines and 16 to 18 rays, the fourth or fifth spine longest and the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.5 to 2.1 times in head length; pelvic-fin length contained 1.8 to 2.3 times in head length for fish 10 to 19 cm standard length, 2.2 to 2.7 times in head length for fish 20 to 38 cm standard length; rear margin of caudal fin convex. Lateral- body scales distinctly ctenoid, with auxiliary scales; lateral-line scales 48 to 53; lateral-scale series 92 to 108. **Colour**: Head, body, and fins generally buff or pale greenish, covered with reddish brown spots and scattered pale blotches; usually 3 to 5 dark brown blotches (groups of dark spots) at base of dorsal fin and a blackish brown blotch on top of caudal peduncle (on some specimens, only the dark blotch at base of last dorsal-fin spines is apparent); rear edge of caudal fin with a row of dark brown spots forming a dark margin; small juveniles with fewer but larger dark spots on the head, body and fins.

Geographical Distribution: A wide-ranging species known from Ascension and St. Helena Islands and in the western Atlantic from Massachusetts (one record), Bermuda, South Carolina, Georgia, Florida, Gulf of Mexico, Caribbean to southern Brazil (Fig. 242). The dubious records of *E. adscensionis* from the Canary Islands, Cape Verde Islands, and South Africa (Barnard, 1927; Smith, 1949; C.L. Smith, 1971) were discussed by Heemstra (1991). This species was not reported by Dooley et al., (1985) in their extensive survey of the fish fauna of the Canary Islands. Wirtz (1992) published a photograph of *E. adscensionis* taken at the island of São Tomé in the Gulf of Guinea.

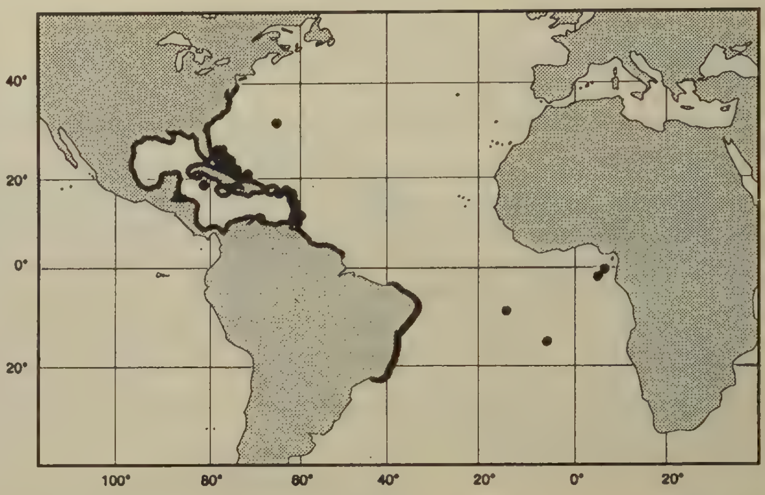


Fig. 242

Habitat and Biology: Rock hind occur on rocky reefs in depths of 2 to 100 m; according to Randall (1967) they feed mainly on crabs (67%) and fishes (20%). At Ascension Island, rock hind include juvenile triggerfish (*Melichthys niger*) and young sea turtles in their diet (Lubbock, 1980). At St. Helena, *E. adscensionis* are common in shallow water and represent 90% of "groundfish" landings; large adults (over 50 cm) are taken regularly in 50 to 100 m, but are rare in shallow water (Edwards and Glass, 1987). Females are mature at 25 cm standard length; ripe females (28 to 36 cm standard length) were noted over a six-month period (January to June) at the Florida Middle Ground (Bullock and Smith, 1991).

Size: In the western Atlantic/Caribbean area, the maximum total length is about 60 cm, with a maximum weight of 3 kg. Bullock and Smith (1991) give a weight/length relationship (combined sexes) for 79 Gulf of Mexico specimens as $W = 5.28 \times 10^{-8} L^{2.905}$, where W (whole weight) is in kilogrammes and L (standard length) is in millimetre. According to Lubbock (1980), the rock hind at Ascension Island may attain a length of "about one metre."

Interest to Fisheries: This species is of minor importance to commercial and sport fisheries in the Western Atlantic, but it is of major importance to the fisheries at Ascension Island and St. Helena. It is caught with hook-and-line, in traps, and with spears.

Local Names: ASCENSION ISLAND: Grouper, Rock cod; BRAZIL: Garoupa-pintada; ST. HELENA: Jack; WEST INDIES: Aguaji.

Literature: Smith (1971); Bauchot et al. (1984); Heemstra (1991).

Remarks: *Serranus luridus* Ranzani was listed as a synonym of *E. adscensionis* by Smith (1971), but neither the original description (Ranzani, 1842:20, no mention of dark spots) nor the illustration (pl. 8, fig. 1, showing a uniformly coloured fish with an emarginate caudal fin) fit *E. adscensionis*. The description and illustration fit *E. morio* better than any other species.

Epinephelus aeneus (E. Geoffroy Saint-Hilaire, 1817)

Fig. 243; Pl. VIIC

SERRAN Epin 3

Serranus aeneus E. Geoffroy Saint-Hilaire, 1817:pl. 21, fig. 3 (description by I. Geoffroy Saint-Hilaire, 1827:317; type locality: Mediterranean coast of Egypt).

Synonyms: ?*Perca robusta* Couch, 1832:21, fig. 7 (type locality: Cornwall, England).

FAO Names: En - White grouper; **Fr** - Mérou blanc; **Sp** - Cherna de ley.

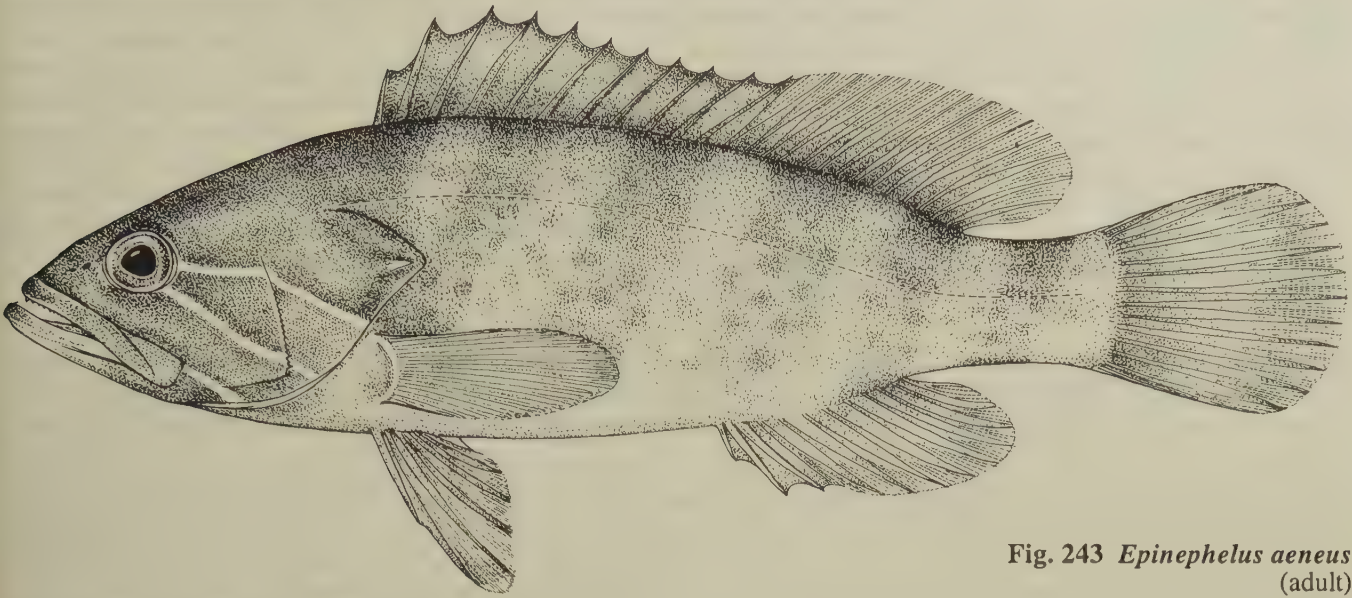


Fig. 243 *Epinephelus aeneus* (adult)

Diagnostic Features: Body depth distinctly less than head length, depth contained 3.0 to 3.6 times in standard length. Head length contained 2.5 to 2.9 times in standard length; interorbital area convex; preopercle angular, with 3 to 6 large spines at the angle, the lowermost directed ventrally; eye diameter equals interorbital width in fish of 20 to 25 cm standard length and is distinctly less than interorbital in larger specimens; rear nostrils slightly bigger than front ones; maxilla reaches about to vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb, total 23 to 26. Dorsal fin with XI spines and 14 to 16 rays, third or fourth spine longest, the interspinous membrane only slightly incised between the spines; anal fin with III spines and 8 (rarely 7 or 9) rays; pectoral-fin rays 18 or 19, longest contained 1.5 to 1.7 times in head length; pelvic-fin origin below base of pectoral fins; caudal fin rounded. Body scales ctenoid; lateral-line scales 67 to 72; lateral-scale series 98 to 102. Pyloric caeca 12 to 14. **Colour**: Greenish bronze, the fins darker, brownish violet, bordered with white or pale mauve; 3 or 4 pale blue (or white) lines across operculum, the lowest from rear end of maxilla to interopercle, the next from eye across preopercle just above the angle and onto subopercle, the uppermost line from eye to upper end of preopercle where it usually bifurcates and continues to rear edge of operculum. Juveniles with faint dark spots on body forming 5 indistinct dark bars; fins also with faint dark spots. In large adults the white lines on the head may be indistinct.

Geographical Distribution: *E. aeneus* occurs throughout the southern Mediterranean and along the west coast of Africa to southern Angola (Fig. 244). Heemstra (1991) mentioned reports from the Canaries and Cape Verde Islands (based on the distribution map of Cadenat, 1935:fig. 29), but these records are unsubstantiated. Brito (1991) did not include *E. aeneus* in his catalogue of the fishes of the Canaries, and he informed us that although this species is often seen in the markets there, the specimens invariably emanate from the continental coast of Africa. The seasonal migration of *E. aeneus* off the coast of Senegal is influenced by the seasonal upwellings off Senegal and Mauritania (Cury and Roy, 1988). The description of *Perca robusta* Couch (1832) was apparently based on a stray individual that was caught off the south coast of England.

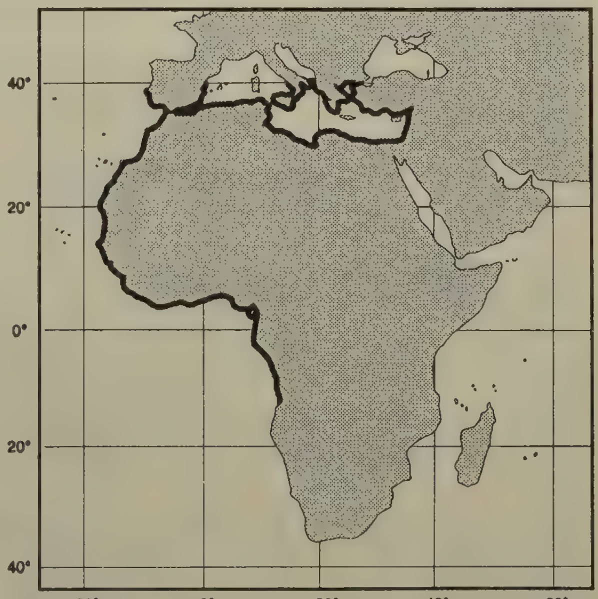


Fig. 244

Habitat and Biology: Adults are found on rocky or mud and sand bottoms in depths of 20 to 200 m; juveniles have been taken in coastal lagoons and estuaries. In west African waters, Longhurst (1960) found that *E. aeneus* feeds on fishes (58%), stomatopods (21%), crabs (10%), and cephalopods (10%).

Beuslé (1985) summarized the published information on the ecology, distribution, and biology of this species. *E. aeneus* is a protogynous hermaphrodite that matures first as a female at 50 to 60 cm total length and a weight of about 3 kg for Tunisian fish. Most females change sex at about 9 kg, but smaller males (of 3 to 5 kg) are occasionally found. Total potential fecundity was estimated to range from 789 436 ova in a 44 cm standard length fish of 2.2 kg to 12 589 242 ova in a 87 cm standard length fish of 12.6 kg. Vadiya (1984) estimated "absolute fecundity" of a 93.5 cm, 8.6 kg ***E. aeneus*** at 3 873 271 ova. Ezzat et al. (1981) used annular rings on scales to determine age and growth of ***E. aeneus*** in Egyptian waters; they found that a 9.7 kg fish was 8 years old. Bouain et al. (1983) studied age, growth, and reproduction of the Tunisian population: the largest fish was 115 cm total length, 25 kg, and was estimated to be 17 years old; females were mature at 5 to 7 years (1.5 to 3.0 kg, 50 to 60 cm total length); and sex change occurs at 10 to 13 years (6 to 15 kg, 80 to 110 cm total length). Development of larvae (2.16 to 8.96 mm standard length) and a prejuvenile of 22.4 mm standard length were illustrated by Aboussouan (1972).

Size: Maximum total length 120 cm; weight 25 kg.

Interest to Fisheries: ***E. aeneus*** is of considerable economic importance in fisheries of the Mediterranean and west coast of Africa. It is caught with hook-and-line and in trawls. In the 1950's this species was abundant along the south coast of Morocco (Furnestin et al., 1958). ***E. aeneus*** has been artificially spawned at the National Center for Mariculture in Israel.

Local Names: ALGERIA: Bades; EGYPT: Wakar; GREECE: Sphyrida; GUINEA: Rikotté; ISRAEL: Daggar mazury; ITALY: Cernia bronzina, Tiof; COTE-D'IVOIRE: Dadassou ekoué, Orousin; LIBYA: Loukouz; MAURITANIA: Arhani; PORTUGAL: Garoupa verde; SENEGAL: Khoutch, Loger, Tiof, Nodiof; SPAIN: Cherne de ley; TUNISIA: Mennani abiad, Mérou blanc; TURKEY: Lahoz; YUGOSLAVIA: Kirnja.

Literature: Cadenat (1935); Poll (1954); Séret (1981); Heemstra (1991).

Remarks: ***Perca robusta*** Couch, 1832 was listed as a synonym of "***Epinephelus guaza***" (= ***E. marginatus***) by C.L. Smith (1971), but Heemstra (1991) considered this species a synonym of ***E. aeneus***.

Epinephelus akaara (Temminck and Schlegel, 1842) Fig. 245; Pl. VIID SERRAN Epin 66

Serranus aka-ara Temminck and Schlegel, 1842:9, pl. 3, fig. 1 (type locality: Nagasaki, Japan).

Synonyms: ***Serranus shihpan*** Richardson, 1846:231 (type locality: Canton, China; based in part on a painting by John Reeves, reproduced by Whitehead and Joysey, 1967:pl. 2, fig. 1). ***Serranus variegatus*** Richardson, 1846:231 (type locality: Canton China; based on a painting by John Reeves, reproduced by Whitehead, 1969:pl. 4, fig. a). ***Epinephelus lobotoides*** Nichols, 1913:179, fig. 1 (type locality: Shimonoseki, Japan). ***Epinephelus ionthas*** Jordan and Metz, 1913:32, pl. 6, fig. 2 (type locality: Pusan, Korea).

FAO Names: **En** - Hong Kong grouper; **Fr** - Mérou rouge tacheté; **Sp** - Mero de pintas rojas.

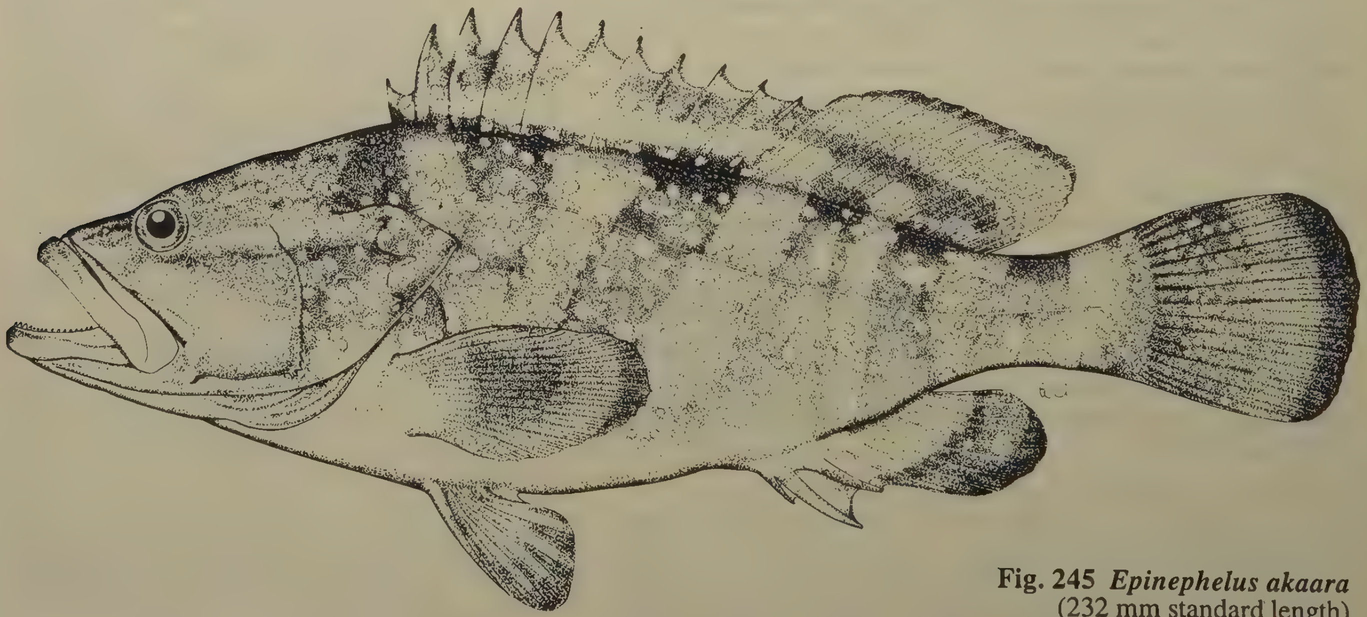


Fig. 245 ***Epinephelus akaara***
(232 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.7 to 3.2 times in standard length (for fish 11 to 38 cm standard length). Head length contained 2.3 to 2.6 times in standard length; preopercle with enlarged serrae at angle; upper edge of operculum straight; nostrils subequal; maxilla reaching about to vertical at rear edge of eye; midside of lower jaw with 2 rows of teeth. Gill rakers 8 or 9 on upper limb, 15 to 17 on lower limb, 23 to 25 total. Dorsal fin with XI spines and 15 to 17 rays, the third to sixth spines longest, their length contained 2.4 to 3.8 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19, pectoral-fin length contained 1.5 to 2.1 times in head length; pelvic fins not reaching anus, their length contained 1.9 to 2.3 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales in adults; lateral-line scales 50 to 54; lateral-scale series 92 to 106. **Colour**: Head and body pale brownish grey, covered (except ventrally) with small red, orange or gold spots; 6 faint oblique dark bars usually visible on body (at least dorsally), the first bar on nape, the third bar confluent with a dark brown or black blotch on body at base of last 3 dorsal-fin spines, and the last bar on caudal peduncle; dark body bars extend only onto base of dorsal fin; dorsal-fin margin yellow or orange; a row of dusky yellow or orange spots (one per membrane) along middle of spinous dorsal fin and another row along base of fin; soft dorsal, caudal, and anal fins with faint red or orange spots basally, the distal parts of these fins dusky with small faint white spots.

Geographical Distribution: Western Pacific: known from southern China, Taiwan, East China Sea, Korea, and southern Japan (Kyushu to about 38°N on both coasts of Honshu) (Fig. 246). Reported from Viet Nam by Fourmanoir (1965), but the illustration appears to be *E. fasciatomaculosus*. Shirai's (1986) records of *E. akaara* from the Philippines and India are unsubstantiated.

Habitat and Biology: In Japanese waters, this species is common in rocky areas. Ukawa et al. (1966) reported pair spawning in shallow culture ponds between 15.30 and 16.30 h. The egg is transparent, 0.70 to 0.77 mm in diameter, with colourless yolk and a single colourless oil globule 0.15 to 0.16 mm in diameter. Hatching occurred after 23 to 25 hours at 25.1 to 27.0 °C, and the newly hatched larvae were 1.45 to 1.56 mm total length. Yolk consumption was completed in 4.5 days; 15-day old larvae were 4.05 mm total length, with elongate dorsal- and pelvic-fin spines, but the caudal fin had not yet developed.

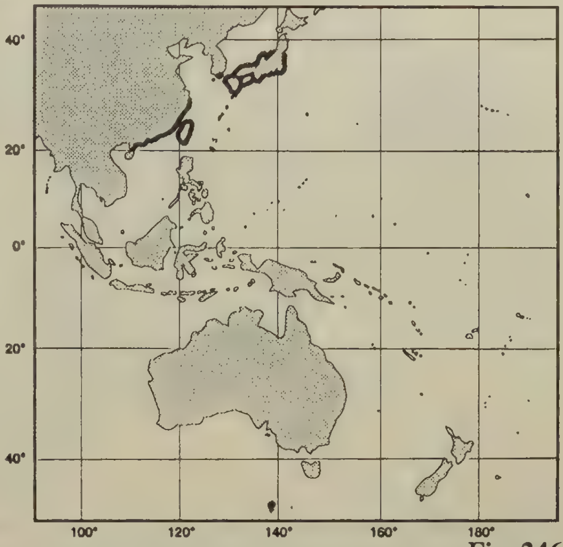


Fig. 246

Mito et al. (1967) described a complete series of larval stages. Larvae of 5.65 mm total length have the second dorsal- and pelvic-fin spines serrate and greatly elongated, and there is a long spine at the angle of the preopercle; at about 12 mm total length the rays of all fins are differentiated, and the greatly elongated dorsal- and pelvic-fin spines begin to shrink. Transformation to the juvenile stage occurs at about 25 mm total length (25 to 26 days after hatching) when many melanophores and orange chromatophores develop rapidly all over the head and body. At 28 mm total length, transformation is mostly completed (except for the spine at the corner of the preopercle, which reaches to the ventral edge of the subopercle), and the colour pattern is recognizable as that of *E. akaara*. Fukuhara and Fushimi (1988) described fin differentiation, squamation and variation of growth in reared larvae. Development of fin rays was completed between 7.3 and 9.6 mm standard length. In the final stages of larval development (at 20 to 27 mm standard length), the elongated second dorsal- and pelvic-fin spines have shortened to adult proportions, the caudal fin becomes rounded, scale development is completed, and the juvenile pigmentation develops.

Size: According to Chan (1968) the maximum total length is 51 cm.

Interest to Fisheries: *E. akaara* is of considerable commercial importance in Hong Kong and Japan where it brings a high price in markets. Although this species spawns readily in captivity, the high mortality of the larvae has hampered its use in aquaculture. In the Hong Kong fishery, wild-caught specimens are often kept alive to be sold for a better price.

Local Names: HONG KONG: Red grouper, Hung-paan; JAPAN: Kijihata.

Literature: Age and growth was studied by Dai et al. (1988) and Li et al. (1988).

Remarks: *E. akaara* is very similar to the sympatric *E. fasciatomaculosus* in meristic and most morphometric features. But the spots on the body of *E. fasciatomaculosus* are dark brown, yellowish brown, or russet (dark in alcohol); the dark bars on the body are darker, with the first two extending to the margin of the spinous dorsal fin; and there are no dusky yellow or orange spots on the spinous dorsal fin. Comparing fishes of 13 to 23 cm standard length, *E. fasciatomaculosus* has a slightly larger eye and more slender caudal peduncle (ratio of peduncle depth/eye diameter is 1.0 to 1.4, and for *E. akaara* it is 1.5 to 2.0).

Epinephelus albomarginatus Boulenger, 1903 Fig. 247; Pl. VIIE SERRAN Epin 26

Epinephelus albomarginatus Boulenger, 1903:65, pl. 4 (type locality: Natal, South Africa).

Synonyms: None.

FAO Names: **En** - White-edged grouper; **Fr** - Mérou bord blanc; **Sp** - Mero bordiblanco.

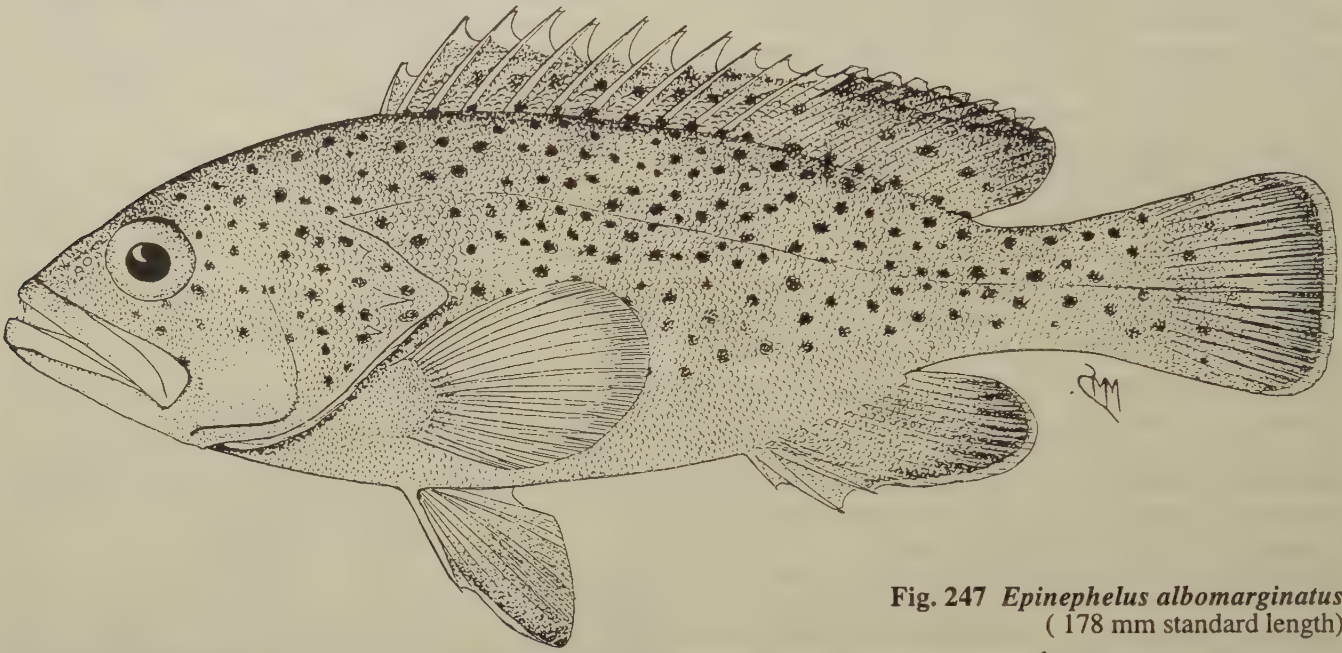


Fig. 247 *Epinephelus albomarginatus* (178 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.6 to 3.0 times in standard length (for fish 15 to 46 cm standard length). Head length contained 2.3 to 2.5 times in standard length; preopercle angular, with 2 or 3 enlarged serrae at the angle; upper edge of operculum straight or convex; diameter of rear nostril about twice that of front one; maxilla naked, without a step on ventral edge; maxilla reaches shorter or longer than vertical at rear edge of eye; midside of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 14 to 16 on lower limb, 22 to 26 total. Dorsal fin with XI spines and 14 rays, the third or fourth spine longest, its length contained 2.6 to 3.4 times in head length, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin with 17 or 18 rays, equal to or slightly longer than pelvic fins, pectoral-fin length contained 1.9 to 2.2 times in head length; pelvic fins not reaching anus; caudal fin truncate, with rounded corners in adults, the rear edge convex in juveniles. Lateral-body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 56 to 66; lateral-scale series 92 to 106. **Colour**: Head, body, dorsal, and caudal fins pale brown, with numerous small dark brown spots; ventral parts of head and body without spots; on juveniles, many of the spots merge to form double spots; prominent dark brown streak along upper edge of maxillary groove. Margin of interspinous dorsal-fin membranes yellow or gold; soft dorsal and anal fins dusky distally, with prominent white edge; upper and lower edges of rear part of caudal fin also white-edged; pectoral fins yellowish or reddish orange.

Geographical Distribution: *E. albomarginatus* is known only from the southeast coast of Africa between Quissico, Mozambique (24°50'S) and East London, South Africa (33°S) (Fig. 248).

Habitat and Biology: Coral or rocky reefs in depths of 10 to 100 m. According to van der Elst (1981), *E. albomarginatus* feeds mainly on spiny lobsters, crabs, and octopus; fishes and squid are also consumed.

Size: Attains at least 100 cm total length and a weight of 13 kg.

Interest to Fisheries: Reasonably common along the coast of Natal, South Africa where it is of interest to anglers.

Local Names: SOUTH AFRICA: Captain Fine, white-edged rockcod.

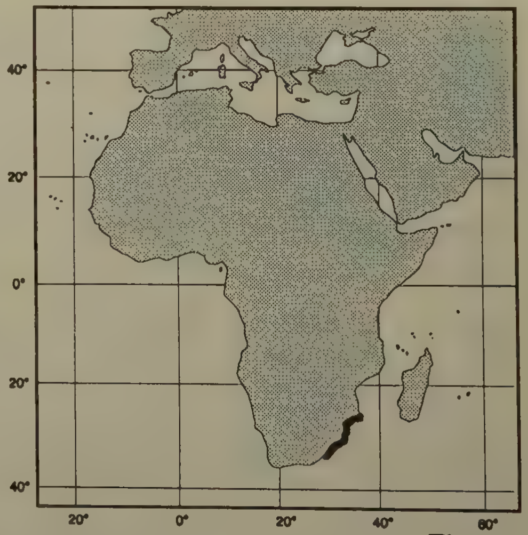


Fig. 248

Epinephelus amblycephalus (Bleeker, 1857) Fig. 249; Pl. VIIF SERRAN Epin 74

Serranus amblycephalus Bleeker, 1857a:32 (type locality: Ambon, Indonesia).

Synonyms: None.

FAO Names: **En** - Banded grouper; **Fr** - Mérou bande; **Sp** - Cabrilla venda.

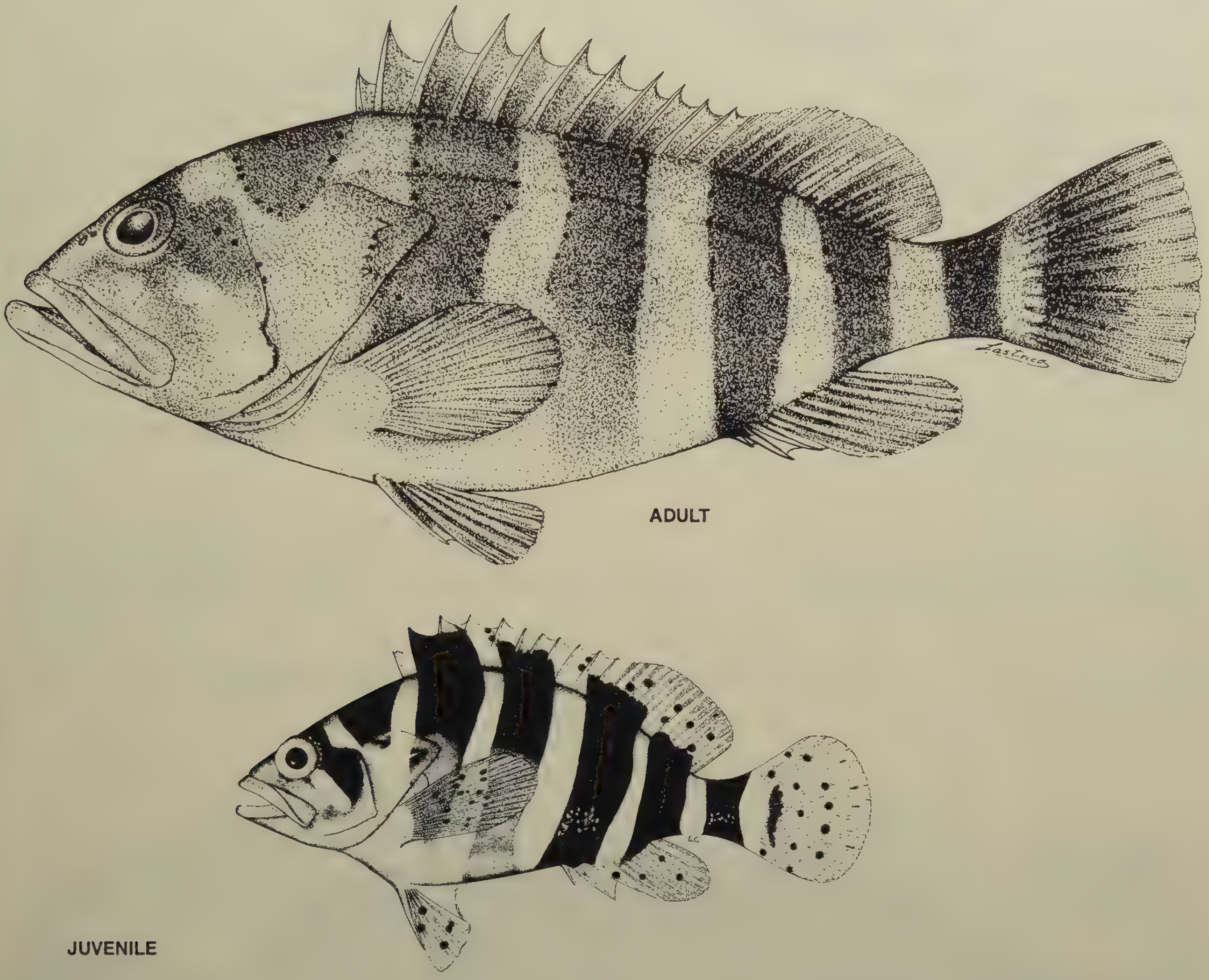


Fig. 249 ***Epinephelus amblycephalus***
(adult 365 mm standard length, juvenile 57 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.5 to 3.0 times in standard length (for fish 12 to 35 cm standard length). Head length contained 2.1 to 2.4 times in standard length; preopercle rounded, with 3 to 6 enlarged serrae at the "corner"; upper edge of operculum slightly convex; nostrils subequal or posterior nostril larger than anterior; maxilla scaly, reaching about to vertical at rear edge of eye; midside of lower jaw with 2 rows of teeth. Gill rakers 8 on upper limb, 14 to 16 on lower limb, 22 to 24 total. Dorsal fin with XI spines and 15 or 16 rays, the third or fourth spine longest, contained 2.7 to 3.2 times in head length, the interspinous membranes only slightly incised; anal fin with III spines and 8 rays; pectoral fins with 18 or 19 rays, pectoral-fin length equal to pelvic-fin length, contained 1.7 to 2.3 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 47 to 52; lateral-scale series 90 to 121. **Colour**: Head, body, and median fins pale grey; body with 4 broad dark brown bars, the first two extending into spinous part of dorsal fin, the third and fourth bars extending into soft dorsal and anal fins; a fifth dark bar at base of caudal fin; small black spots on dorsal parts of body bars (mainly along the edges of the bars); dark brown saddle blotch on nape, with small black spots mainly along edge of this blotch; cheeks, snout, interorbital area, jaws, and chest mostly dark brown, with 2 or 3 white bands radiating from eye; irregular black bar on middle of caudal fin; maxillary groove yellow; ventral parts of head and body often with a pinkish tinge. Small juveniles (6 cm standard length) white, with black bars on body as described for adults, the fins pale yellow with small black spots.

Geographical Distribution: *E. amblycephalus* is known from the Andaman Sea to southern Japan, Taiwan, China, Philippines, Viet Nam, Malaysia, Thailand, Indonesia, New Guinea, northwestern Australia, and Fiji (Fig. 250).

Habitat and Biology: Coral and rocky reefs in depths of 80 to 130 m. Tseng and Chan (1985) discussed food, rearing procedures, and larval development of specimens from Hong Kong.

Size: Maximum total length 50 cm.

Interest to Fisheries: According to Tseng and Chan (1985), *E. amblycephalus* is a popular and commercially important species in Hong Kong; but in Singapore it is "Not a popular grouper in the market." (Tan et al., 1982). Caught with hand lines. Sold fresh.

Local Names: JAPAN: Kokuten-aohata; MALAYSIA: Anak pertang; SINGAPORE: Anak keretang.

Literature: Randall and Heemstra (1991).

Remarks: *E. amblycephalus* is not known east of New Guinea except for the record of a specimen at Fiji (based on a photograph supplied by Tony Lewis).

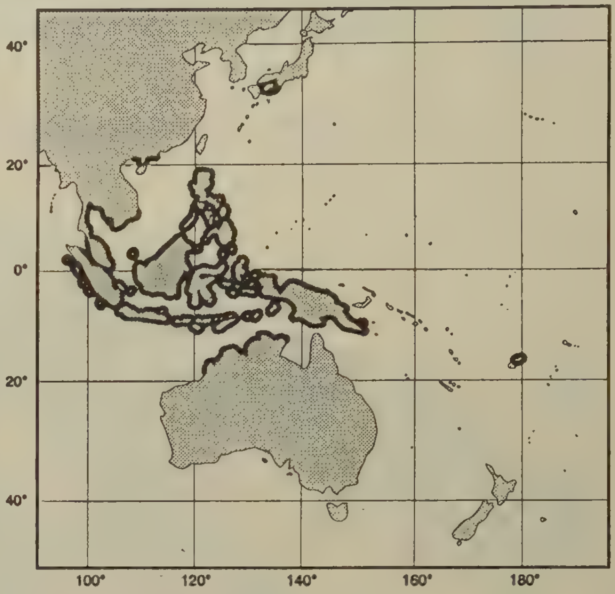


Fig. 250

Epinephelus analogus Gill, 1864

Fig. 251; Pl. VIIIA

SERRAN Epin 60

Epinephelus analogus Gill, 1864:163 (type locality: west coast of Panama).

Synonyms: *Serranus courtadei* Bocourt, 1868:222 (type locality: La Union, El Salvador).

FAO Names: **En** - Spotted grouper; **Fr** - Mérou cabrilla; **Sp** - Mero moteado.

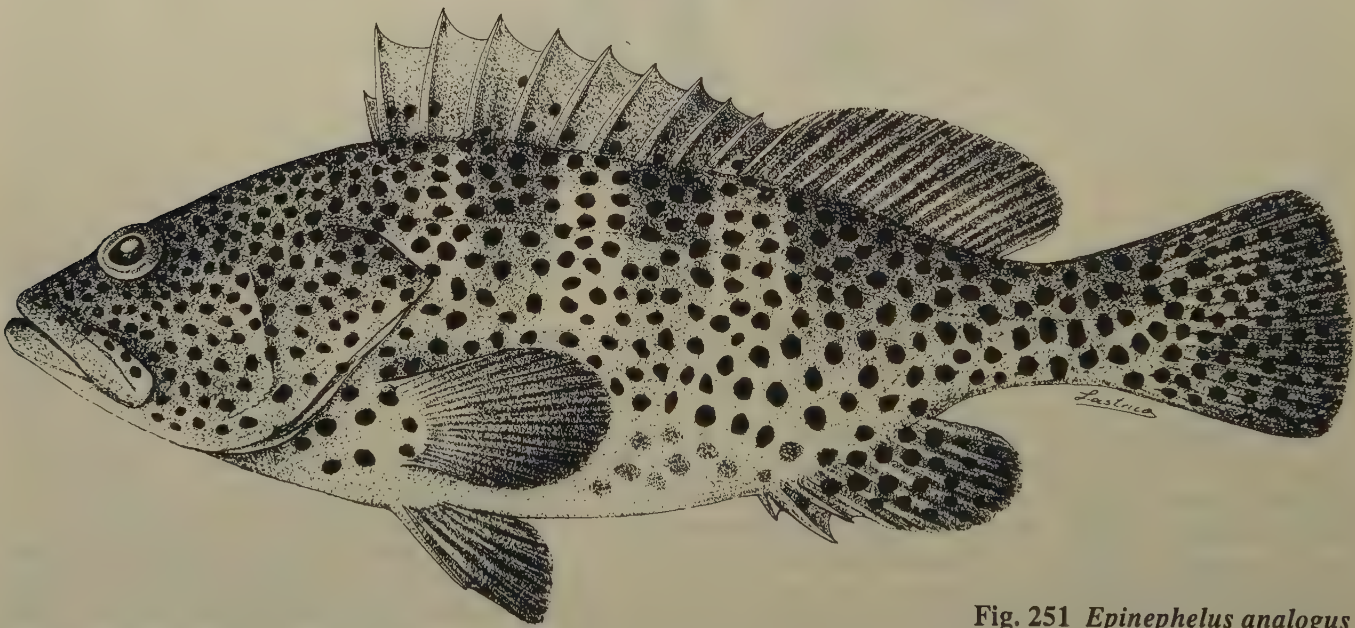


Fig. 251 *Epinephelus analogus*
(about 750 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 3.0 times in standard length (for fish 10 to 32 cm standard length). Head length contained 2.3 to 2.5 times in standard length; preopercle with a shallow notch above the angle, the serrae at angle slightly enlarged; upper edge of operculum slightly convex; nostrils subequal. Total gill rakers 26 to 28. Dorsal fin with X spines and 16 to 18 rays, the third spine longest and the membranes moderately incised between the spines; anal fin with

III spines and 8 rays; pectoral fins with 19 or 20 rays; pelvic fins distinctly shorter than pectoral fins and their origin below or behind lower end of pectoral-fin base; caudal fin rounded. Midlateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 53 to 69; lateral-scale series 96 to 112. **Colour**: Generally reddish brown covered with dark brown spots; body with 5 faint, oblique, dark bars.

Geographical Distribution: Eastern Pacific from southern California to Peru and the Galapagos Islands. The spotted grouper is the most abundant small grouper in the northern Gulf of California (Fig. 252).

Habitat and Biology: This species is abundant on offshore patch reefs where it is readily caught by anglers. It feeds mainly on crustaceans and fishes on rocky and sandy bottoms; in winter it moves closer to shore where it feeds heavily on swarms of the pelagic red crab, *Pleuroncodes planipes*.

Size: Maximum total length about 75 cm; maximum weight probably around 9 kg.

Interest to Fisheries: Spotted grouper are of importance to anglers and local hand-line fisheries.

Local Names:

Literature: Smith (1971); Thomson et al. (1979).

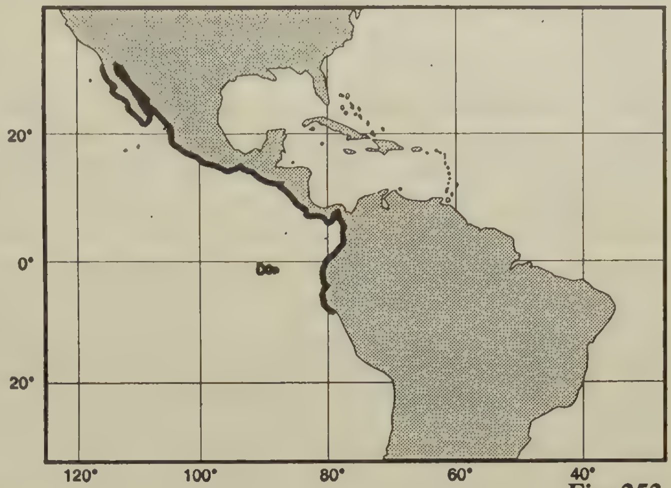


Fig. 252

Epinephelus andersoni Boulenger, 1903

Fig. 253; Pl. VIIIB

SERRAN Epin 27

Epinephelus andersoni Boulenger, 1903:66, pl. 5 (type locality: Natal, South Africa).

Synonyms: None.

FAO Names: **En** - Catface grouper; **Fr** - Mérou chat; **Sp** - Mero gato.

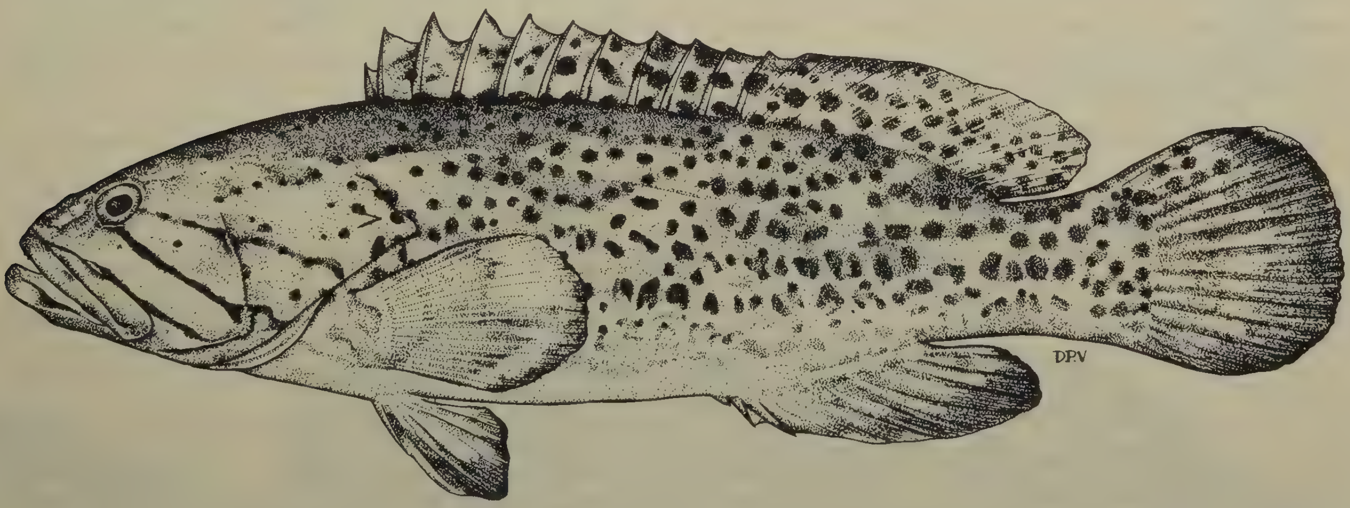


Fig. 253 *Epinephelus andersoni*
(372 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.2 to 3.7 times in standard length (for fish 10 to 50 cm standard length); greatest body width contained 1.4 to 1.8 times in body depth. Head length contained 2.4 to 2.7 times in standard length; preopercle angular, with several enlarged serrae at the angle; upper edge of operculum slightly convex; nostrils equal in size; maxilla scaly, reaching to or past vertical at rear edge of eye; midside of lower jaw with 2 or 3 rows of teeth. Gill rakers shorter than gill filaments, 8 to 11 on upper limb, 14 to 17 on lower limb, 22 to 27 total. Dorsal fin with XI spines and 13 to 15 rays, the third or fourth spine longest, its length contained 2.9 to 3.9 times in head length, the interspinous membranes moderately incised; anal fin with III spines and 8 rays; pectoral fins with 17 to 19 rays, their length contained 1.5 to 2.0 times in head length; pelvic-fin length contained 2.1 to 2.6 times in head length; caudal fin well rounded. Midlateral-body scales ctenoid (although mostly embedded), with auxiliary scales; lateral-line scales 66 to 74; lateral-scale series 97 to 106. **Colour**: Head, body, and fins brown; body, caudal, and dorsal fins with numerous, small, close-set, irregular, dark brown spots; 2 dark brown stripes posteriorly from eye across operculum and another continuing from maxillary groove to lower edge of preopercle. Juveniles with longitudinal dark stripes that break up into spots posteriorly on body; black blotch at base of last few dorsal-fin spines; 2 small black spots at base of dorsal-fin rays, and a third on top of caudal peduncle; these black blotches separated by 4 or 5 white spots.

Geographical Distribution: *E. andersoni* is known with certainty only from the southeast coast of Africa between Quissico, Mozambique (24°50'S) and Knysna, South Africa (23°E) (Fig. 254). Reports from Madagascar (Fourmanoir, 1957) are dubious.

Habitat and Biology: Rocky bottom from shore to depths of at least 50 m; juveniles are found in tidepools. According to van der Elst (1981), *E. andersoni* is a sedentary ambush predator that feeds on fishes, crabs, and spiny lobsters. Sexual maturity is attained at a length of 50 to 60 cm.

Size: Maximum total length at least 80 cm.

Interest to Fisheries: This species is primarily of interest to sportfishermen.

Local Names: SOUTH AFRICA: Catface rockcod, Captain Fine, Spotted rockcod.

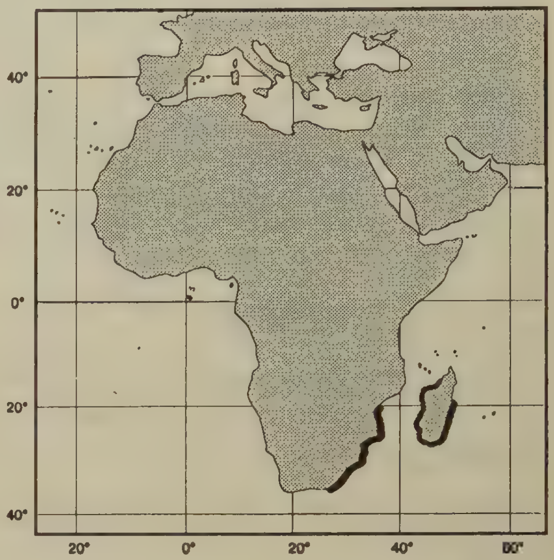


Fig. 254

Epinephelus areolatus (Forsskål, 1775)

Fig. 255; Pl. VIIIC

SERRAN Epin 4

Perca areolata Forsskål, 1775:42 (type locality: Jeddah, Saudi Arabia, Red Sea).

Synonyms: *Bodianus melanurus* Geoffroy Saint-Hilaire, 1809:317, pl. 21, fig. 1 (type locality: Suez, Red Sea). *Serranus angularis* Valenciennes in Cuv. and Val., 1828:353 (type locality: Sri Lanka). *Serranus celebicus* Bleeker, 1851a:217 (type locality: Bulucomba, Sulawesi [Celebes], Indonesia). *Serranus Waandersii* Bleeker, 1858a:152 (type locality: Boleling, Bali, Indonesia). *Serranus glaucus* Day, 1870:678 (type locality: Andaman Islands, Indian Ocean). *Epinephelus craspedurus* Jordan and Richardson, 1910:447, fig. 7 (type locality: Kagoshima, Japan).

FAO Names: **En** - Areolate grouper; **Fr** - Mérou aréolé; **Sp** - Mero areolado.

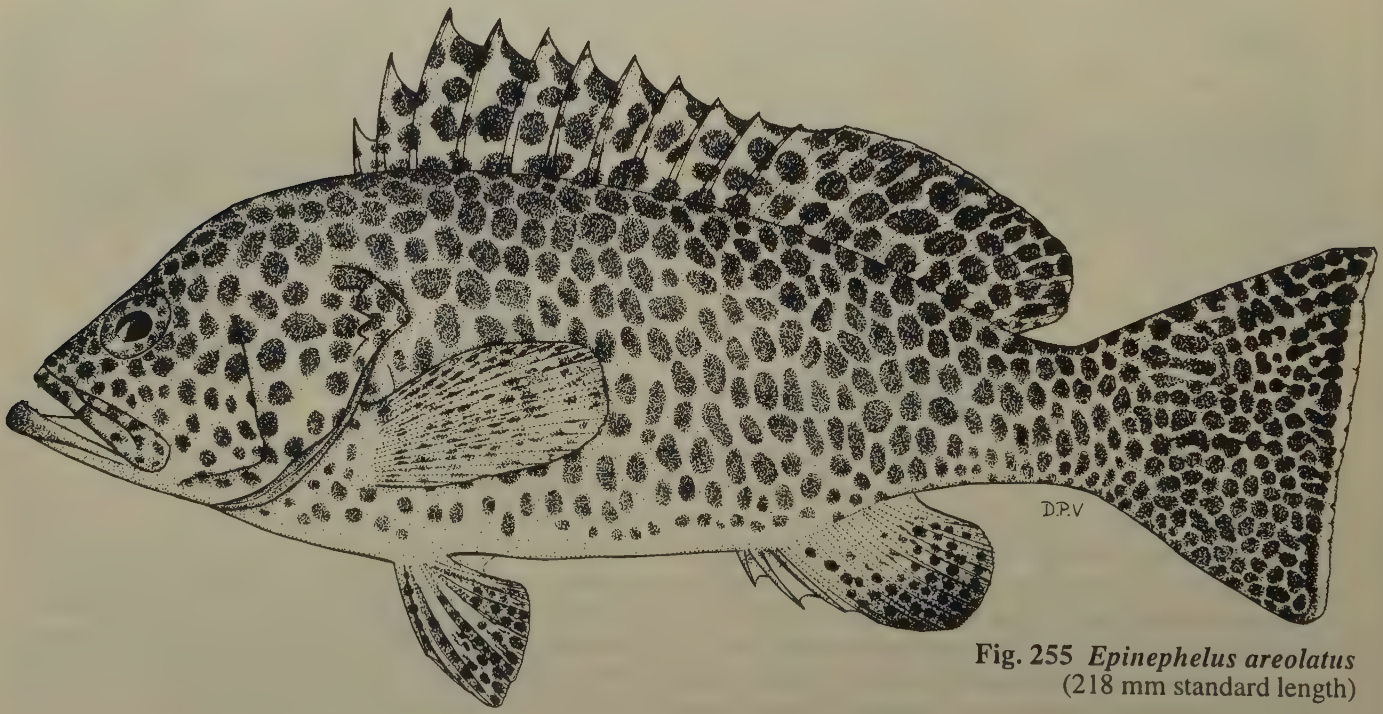


Fig. 255 *Epinephelus areolatus* (218 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.8 to 3.3 times in standard length (for fish 14 to 31 cm standard length). Head length contained 2.4 to 2.8 times in standard length; interorbital area convex; preopercle angular, with 2 to 7 enlarged serrae at the angle; upper edge of operculum straight or slightly convex; nostrils subequal; maxilla extending to below rear half of eye, the lower edge with a distinct step posteriorly; maxilla, lower jaw and gular area scaly; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 14 to 16 on lower limb, total 23 to 25. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest and subequal to longest ray, the interspinous membranes moderately incised; anal fin with III spines and 8 rays, the margin rounded or angular; pectoral-fin rays 17 to 19; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic-fin length contained 1.7 to 2.1 times in head length, reaching to or nearly to anus; caudal fin slightly convex in juveniles, truncate or slightly emarginate in adults. Lateral-body scales ctenoid; adults with auxiliary scales; lateral-line scales 49 to 53; lateral-scale series 97 to 116. Pyloric caeca 11 to 17. **Colour**: Head, body, and fins pale, covered with numerous close-set brown, brownish yellow, or greenish yellow spots, the largest about size of pupil, those on front of head smaller than those on operculum. Pectoral fins pale, with small dark spots on the rays. Posterior edge of caudal fin with a distinct white margin.

Geographical Distribution: *E. areolatus* occurs in the Red Sea, Persian Gulf, and western Indian Ocean south to Natal, South Africa; its range extends eastward to India, Sri Lanka, Andaman Islands, Thailand, Malaysia, Viet Nam, Indonesia, Philippines, Hong Kong, China, Taiwan, Japan, northern Australia (and nearby islands), Papua New Guinea, New Caledonia, and Fiji. It appears to be absent from Micronesia, Polynesia, and most of the islands of the western Indian Ocean (e.g., Madagascar, Mascarenes, Comoros, Chagos Archipelago, and the Maldives). It has been taken at the Seychelles (market specimen) and the Laccadives (Fig. 256).

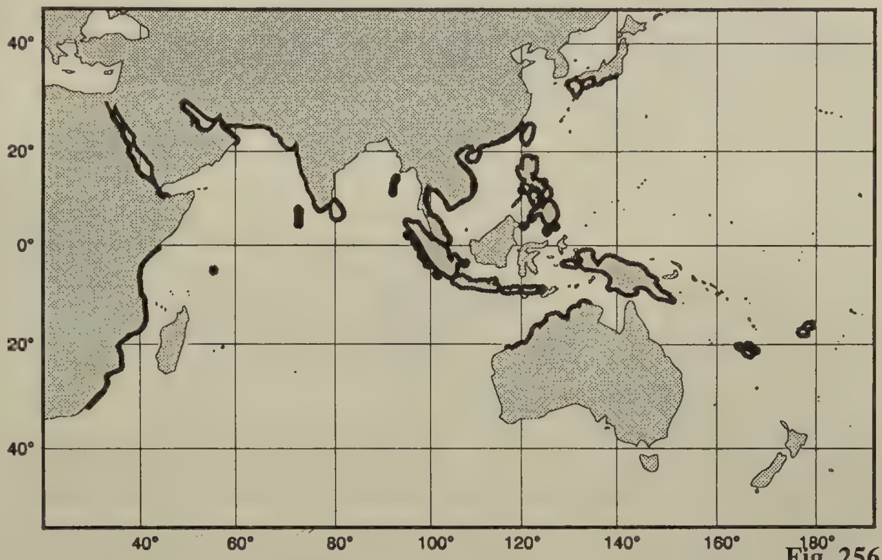


Fig. 256

Habitat and Biology: This species is usually found in seagrass beds or on fine sediment bottoms near rocky reefs, dead coral, or alcyonarians. It has been taken in depths of 6 to 200 m. At New Caledonia, *E. areolatus* was reported to feed on penaeid prawns (Fourmanoir and Laboute, 1976).

Size: Maximum total length about 40 cm (31 cm standard length).

Interest to Fisheries: *E. areolatus* is common in the markets of Hong Kong, Singapore, and probably throughout its range. Caught with hook-and-line, traps, and in trawls.

Local Names: AUSTRALIA: Yellow-spotted rockcod; HONG KONG: Chai-may-tsee-mah-paan; JAPAN: Omon-hata; KUWAIT: Gatow; MAURITIUS: Vielle plate; NEW CALEDONIA: Loche aréolée; SEYCHELLES: Vielle maconde; SINGAPORE: Kerapu ekor puteh; SOUTH AFRICA: Squaretail rockcod.

Literature: Tan et al. (1982); Randall and Ben-Tuvia (1983); Randall and Heemstra (1991).

Remarks: *E. areolatus* has often been confused with *E. chlorostigma*, which is also covered with brown spots and has a truncate or emarginate caudal fin with a white posterior margin. But *E. chlorostigma* has modally one more dorsal- and pectoral-fin ray, 2 more gill rakers, and smaller, more numerous, dark brown spots, with the largest dark spots on body about half of the size of the pupil; also the dark spots are closer together, with the pale interspaces forming a pale network on the head, body and median fins.

Epinephelus awoara (Temminck and Schlegel, 1842) Fig. 257; Pl. VIIID,E SERRAN Epin 5

Serranus awo-ara Temminck and Schlegel, 1842:9, pl. 3, fig. 2 (type locality: Nagasaki, Japan).

Synonyms: None.

FAO Names: **En** - Yellow grouper; **Fr** - Mérou jaune; **Sp** - Mero amarillo.

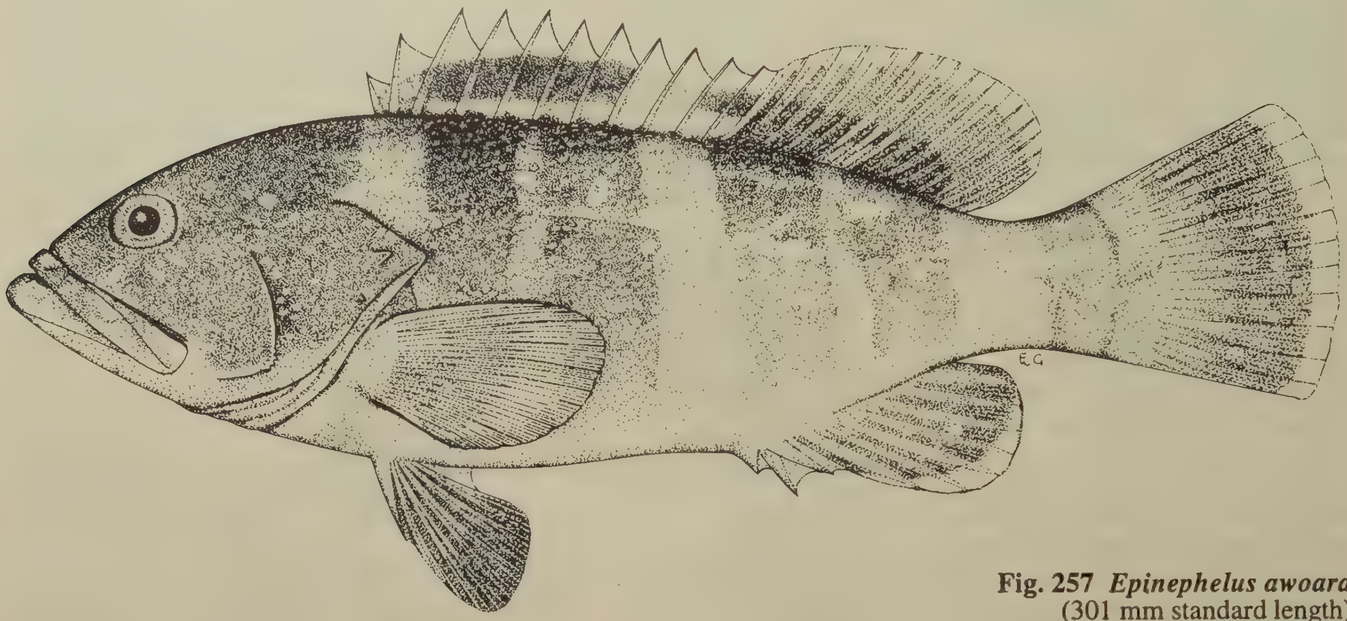


Fig. 257 ***Epinephelus awoara***
(301 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.3 times in standard length (for fish 13 to 31 cm standard length). Head length contained 2.25 to 2.6 times in standard length; interorbital area convex; dorsal head profile strongly convex; preopercle subangular, with 2 to 5 strong spines at the angle; upper edge of operculum straight, the uppermost spine rudimentary; maxilla reaches about to vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of small, subequal teeth. Gill rakers 8 or 9 on upper limb, 16 to 18 on lower limb, total 22 to 26. Dorsal fin with XI spines and 15 or 16 rays, the third or fourth spine longest but shorter than the longest ray, the interspinous membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.6 to 1.9 times in head length; caudal fin convex. Lateral-body scales distinctly ctenoid, with auxiliary scales in fish larger than 30 cm standard length; lateral-line scales 49 to 55; lateral-scale series 92 to 109. Pyloric caeca 12, in 3 bundles. **Colour:** Head and body pale greyish brown dorsally, usually golden yellow ventrally; 4 broad dark bars on dorsal part of body, one on caudal peduncle and another often visible on nape; head and body with numerous small yellow spots; body and median fins also with small greyish white spots; soft dorsal, caudal, and sometimes the anal fin with prominent yellow margin; paired fins dusky yellow. Dark bars on body may be faint or absent in large adults.

Geographical Distribution: *E. awoara* occurs in the western North Pacific Ocean; it is known from Korea, Japan, Taiwan, China, Viet Nam, and islands in the South China Sea (Fig. 258).

Habitat and Biology: This species is found in rocky areas as well as on sandy-mud bottoms. Juveniles are common in tidepools, and adults are caught in depths of 10 to 50 m. In captivity, *E. awoara* is an aggressive fish, spending much of its time chasing and biting other fishes, especially members of its own species.

Size: Maximum total length at least 60 cm.

Interest to Fisheries: *E. awoara* is a valuable food fish, which is caught with trawls or hook-and-line. Artificial fertilization of eggs was accomplished by Zhang and Li (1988), and the longest survival time for the larvae was 15 days.

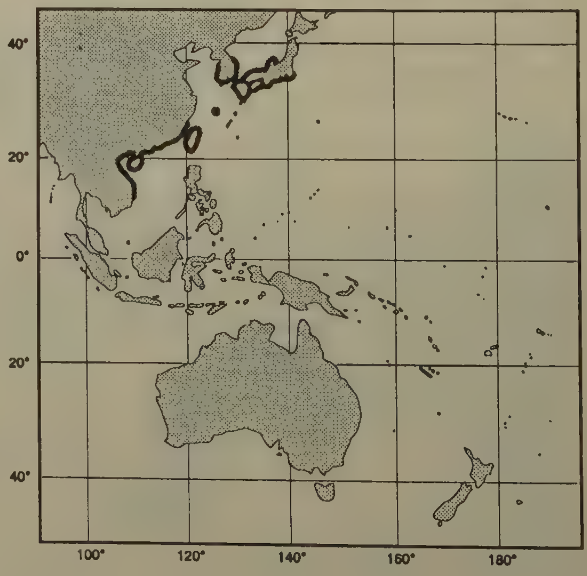


Fig. 258

Local Names: HONG KONG: Wong-paan (large fish), Wong-dang (small fish); JAPAN: Aohata.

Literature: Chan (1968); Randall and Heemstra (1991).

Remarks: The fish illustrated as "*Epinephelus awoara*" by Lindberg and Krasyukova (1971:fig. 145) appears to be *E. trimaculatus*.

Epinephelus bilobatus Randall and Allen, 1987

Fig. 259; Pl. VIIIF

SERRAN Epin 82

Epinephelus bilobatus Randall and Allen, 1987:391, 406, fig. 4 (type locality: Rosemary Island, Dampier Archipelago, Western Australia).

Synonyms: None.

FAO Names: **En** - Twinspot grouper; **Fr** - Mérou gemine; **Sp** - Mero de pintas gemelas.

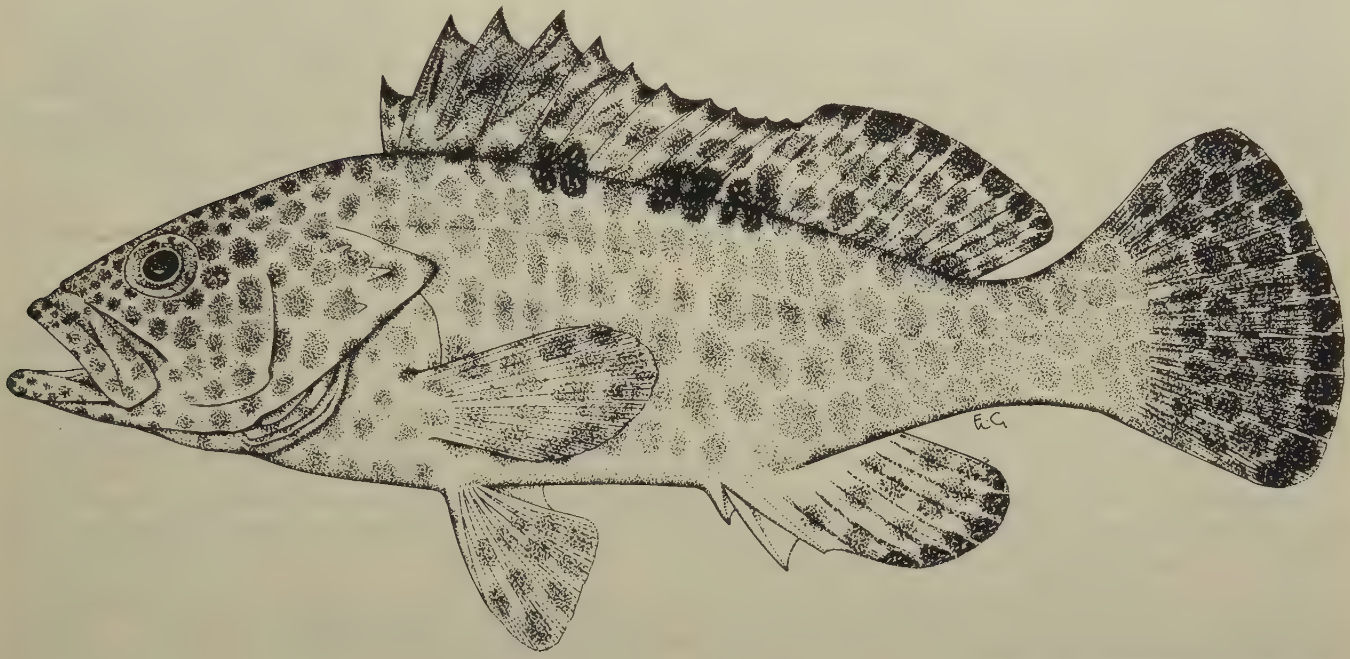


Fig. 259 ***Epinephelus bilobatus***
(156 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 8 to 27 cm standard length). Head length contained 2.4 to 2.6 times in standard length; preopercle subangular, with the serrae at the angle slightly enlarged; opercular spines inconspicuous; upper edge of operculum straight or slightly concave; nostrils subequal in small fish, but rear nostril diameter about twice that of anterior nostril in a fish of 27 cm standard length; maxilla reaches below rear half of eye; midlateral part of lower jaw with 2 rows of small teeth. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb, total 23 to 25. Dorsal fin with XI spines and 17 or 18 rays, the third or fourth spine longest (contained 2.1 to 2.5 times in head length) and slightly longer than the longest dorsal-fin ray, the interspinous membranes slightly to moderately incised; anal fin with III spines and 8 rays, the second and third spines subequal, their length contained 2.5 to 3.2 times in head length; pectoral-fin rays 17 to 19; pectoral fins longer than pelvic fins, pectoral-fin length contained 1.5 to 1.8 times in head length; caudal-peduncle depth contained 3.2 to 3.6 times in head length; caudal fin rounded. Lateral-body scales ctenoid; auxiliary scales present or absent; lateral-line scales 48 to 52; lateral-scale series 94 to 102. **Colour:** Head and body pale, covered with indistinctly defined, dark orange-brown spots; dark spots extend onto soft dorsal, caudal, and anal fins where the pale interspaces form a network pattern; the spots along the margin of these fins are darker than other spots; a series of 3 bilobed dark blotches or close-set pairs of dark brown to black spots along base of dorsal fin and adjacent body; dorsal part of body of fresh specimens with a pale bluish grey tinge; spinous dorsal fin dusky, with indistinct dark spots and a blackish margin; paired fins also with dark brown spots. Dark brown line in maxillary groove.

Geographical Distribution: *E. bilobatus* is known only from northwestern Australia. A frozen specimen was purchased in the market at Hengchun, Taiwan; but this fish was from a trawler that had been fishing in foreign waters, and its place of origin could not be determined (Fig. 260).

Habitat and Biology: Coral reefs and rocky bottom in depths of 4 to 50 m. There is no published information on the biology of this species.

Size: Maximum total length at least 33 cm.

Interest to Fisheries: No information is available.

Local Names: AUSTRALIA: Frostback rockcod.

Literature: Randall and Allen (1987); Randall and Heemstra (1991).

Remarks: *E. bilobabtus* was illustrated in colour (as *"Epinephelus maculatus"*) by Allen (1985) and Sainsbury et al. (1985).

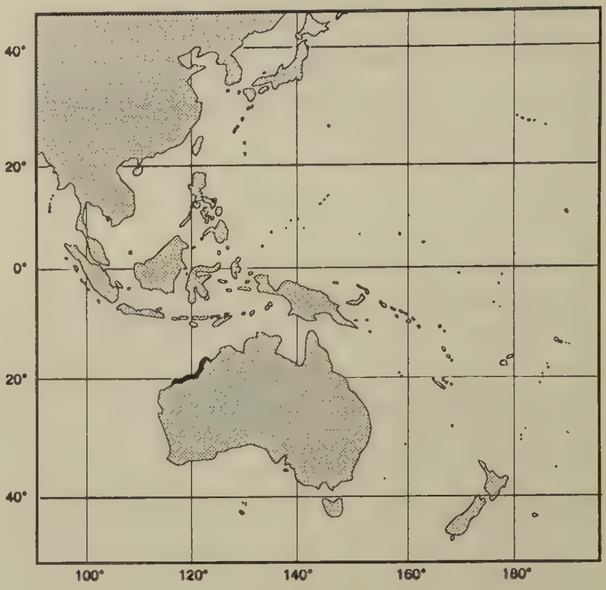


Fig. 260

E. bilobatus is one of a group of 9 shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These species have been much confused in the literature, and many museum specimens have been misidentified. The other "reticulated groupers" differ from ***E. bilobatus*** as follows:

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), shorter dorsal-fin spines (length of fourth spine contained 2.6 to 3.9 times in head length), and dark spots on body at dorsal-fin base not bilobed or in pairs.

E. hexagonatus has conspicuous white dots on the body between the dark spots, dark spots on body at dorsal-fin base not bilobed or in pairs, dorsal-fin rays 15 to 17, and second anal-fin spine much longer than third spine.

E. macrospilos has the lateral-body scales mostly smooth, pectoral fins dusky with narrow white edge, dark spots on body at dorsal-fin base not bilobed or in pairs and rear edge of caudal fin pale yellow or white.

E. maculatus has the dorsal-fin membranes not incised between the spines; juveniles yellowish brown, with a few small black spots (mainly on head and fins) and a few large irregular white blotches on head, body, and fins; dorsal-fin rays 15 to 17; lateral-scale series 102 to 120.

E. melanostigma has a single black blotch at base of last 4 dorsal-fin spines, dorsal-fin rays 14 to 16, lateral-line scales 56 to 68, and midlateral part of lower jaw with 3 to 5 rows of teeth.

E. merra has dark spots on body at dorsal-fin base not bilobed or in pairs, pectoral fins with small black spots largely confined to the rays, dorsal-fin rays 15 to 17, and fourth to ninth dorsal-fin spines subequal (the longest contained 2.6 to 2.9 times in head length).

E. quoyanus has dark spots on body at dorsal-fin base not bilobed or in pairs, pectoral fins with indistinct dark brown spots, the base with large semicircular dark brown spot edged posteriorly with white, 2 oblique dark brown bands or blotches linked by bands on sides of chest, pectoral-fin length more than 25% of standard length and contained 1.2 to 1.7 times in head length, third to fifth dorsal-fin spines longest and contained 2.3 to 3.0 times in head length.

E. spilotoceps has dorsal-fin rays 14 to 16, lateral-line scales 59 to 69, fourth dorsal-fin spine usually longest (its length contained 2.7 to 3.5 times in head length), 3 brownish black blotches or spots on body at base of dorsal fin but these are not bilobed or in pairs, and caudal-peduncle depth contained 3.7 to 4.3 times in head length.

Epinephelus bleekeri (Vaillant, 1877)

Fig. 261; Pl. IXA,B

SERRAN Epin 6

Serranus Bleekeri Vaillant in Vaillant and Bocourt, 1877:47 and 69 (based on *Serranus variolosus* [non Valenciennes]: Bleeker, 1849).

Synonyms: *Serranus variolosus* (non Valenciennes): Bleeker, 1849:35 (Indonesia). *Epinephelus Dayi* Bleeker, 1875:47 (based on *Serranus Waandersii* [non Bleeker]: Day, 1875:12, pl. 8, fig. 1 from India; preoccupied by *Epinephelus Dayi* Bleeker, 1873 [a synonym of *E. diacanthus*]). *Serranus Coromandelicus* Day, 1878 (replacement name for *Epinephelus Dayi* Bleeker, 1875). *Epinephelus albimaculatus* Seale, 1909:509, pl. 8 (type locality: Mindanao, Philippines).

FAO Names: **En** - Duskytail grouper; **Fr** - Mérou demideuil; **Sp** - Mero medioluto.

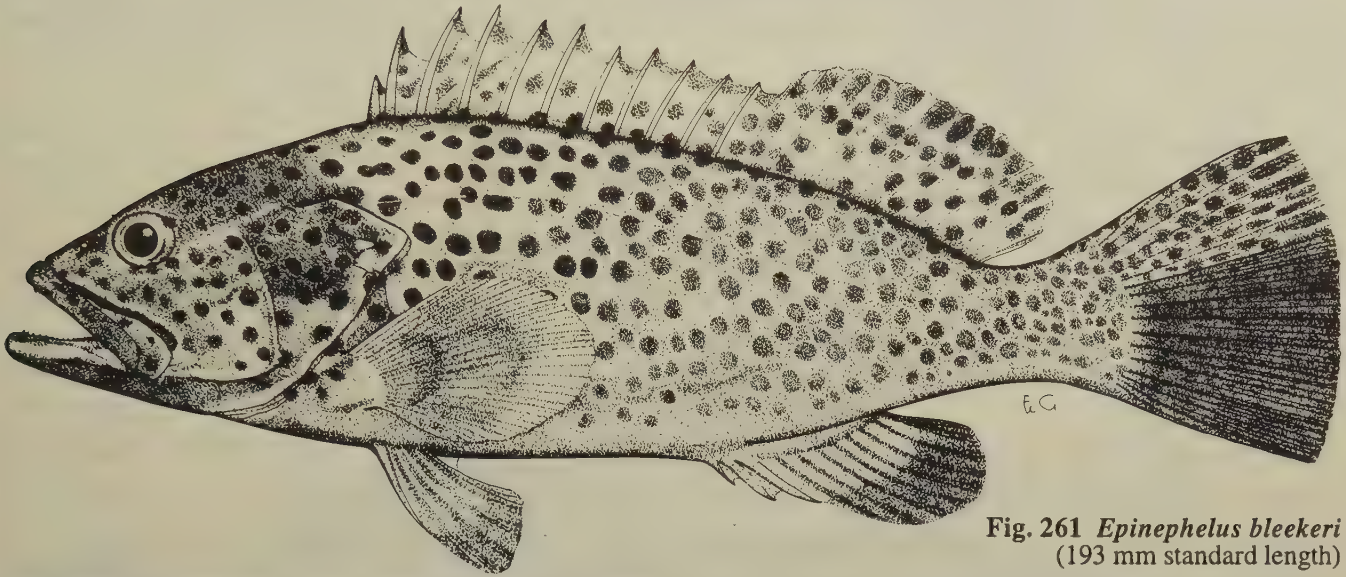


Fig. 261 *Epinephelus bleekeri*
(193 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.5 times in standard length (for fish 11 to 52 cm standard length). Head length contained 2.4 to 2.7 times in standard length; interorbital area flat to slightly convex; preopercle angle with 2 to 9 enlarged serrae; adults with a notch above preopercle angle; upper edge of operculum straight; maxilla scaly, reaching to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of subequal teeth. Gill rakers 9 to 11 on upper limb, 16 to 18 on lower limb, 25 to 28 total. Dorsal fin with XI spines and 16 to 18 rays, third to fifth spines longest, the interspinous membranes incised; anal fin with III spines and 8 or 9 (rarely 9) rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic-fin length contained 1.9 to 2.5 times in head length; caudal fin truncate or slightly convex. Lateral-body scales ctenoid; adults with a few small auxiliary scales; lateral-line scales 49 to 53; lateral-scale series 99 to 104. **Colour**: Head and body brownish, reddish brown or purplish grey, covered (except ventrally) with numerous reddish orange, gold, or yellow spots; dorsal fin and upper third of caudal fin with spots like those on body; lower two-thirds of caudal fin dusky; spots on body of some fish with a faint dark margin; pectoral and pelvic fins and distal part of anal fin dusky; dark streak along maxillary groove. Juveniles (less than 11 cm standard length) with 7 faint dark bars dorsally on body, the first two on nape, the last on caudal peduncle; all bars more or less demarcated by small dark spots; no dark spots on head or fins.

Geographical Distribution: *E. bleekeri* is an Indo-West Pacific species occurring from the Persian Gulf to Taiwan, Indonesia and the northern coast of Australia. We have examined specimens from Bahrain, Iran, India, Thailand, Cambodia, Indonesia, Borneo, Philippines, China, Hong Kong, Taiwan, and Australia. If is not known from Japan or New Guinea, but it may occur there. It has not been found at any of the islands of Micronesia or Polynesia (Fig. 262).

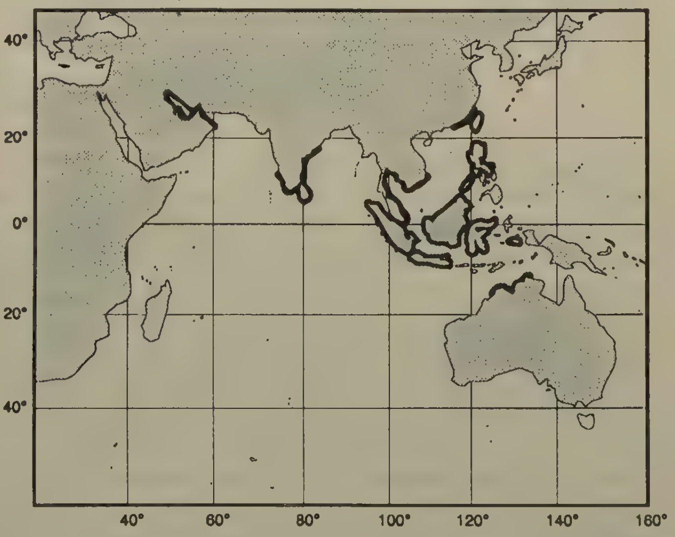


Fig. 262

Habitat and Biology: *E. bleekeri* occurs on shallow rocky banks, but it is not known from well-developed coral reefs. The depth range for this species has been reported as 30 to 104 m.

Size: Maximum total length about 76 cm, according to Chan (1968).

Interest to Fisheries: An excellent eating fish, but it is apparently not abundant. Caught with hook-and-line, longlines, and trawls.

Local Names: HONG KONG: Hung-paan; INDONESIA: Kerapo-tutol, Balong; SINGAPORE: Bleeker's grouper, Jiao zhï hou, Chi hou, Hua hou.

Literature: Randall and Heemstra (1991).

Remarks: It is ironic that ***E. bleekeri*** was twice misidentified and then three new names were given to this species. According to information supplied by Dr Marie-Louise Bauchot and Martine Desoutter, Vaillant's description of ***Serranus Bleekeri*** was published in the second instalment of the work by Vaillant and Bocourt (p. 41 to 120) on 31 October 1877. It thus predates the other replacement name, ***Serranus Coromandelicus***, of Day (1878).

Epinephelus bontoides (Bleeker, 1855)

Fig. 263; Pl. IXC SERRAN Epin 86

Serranus bontoides Bleeker, 1855c:405 (type locality: Ambon, Molucca Islands).

Synonyms: None.

FAO Names: **En** - Palemargin grouper; **Fr** - Mérou bord clair; **Sp** - Mero de márgenes pálidos.

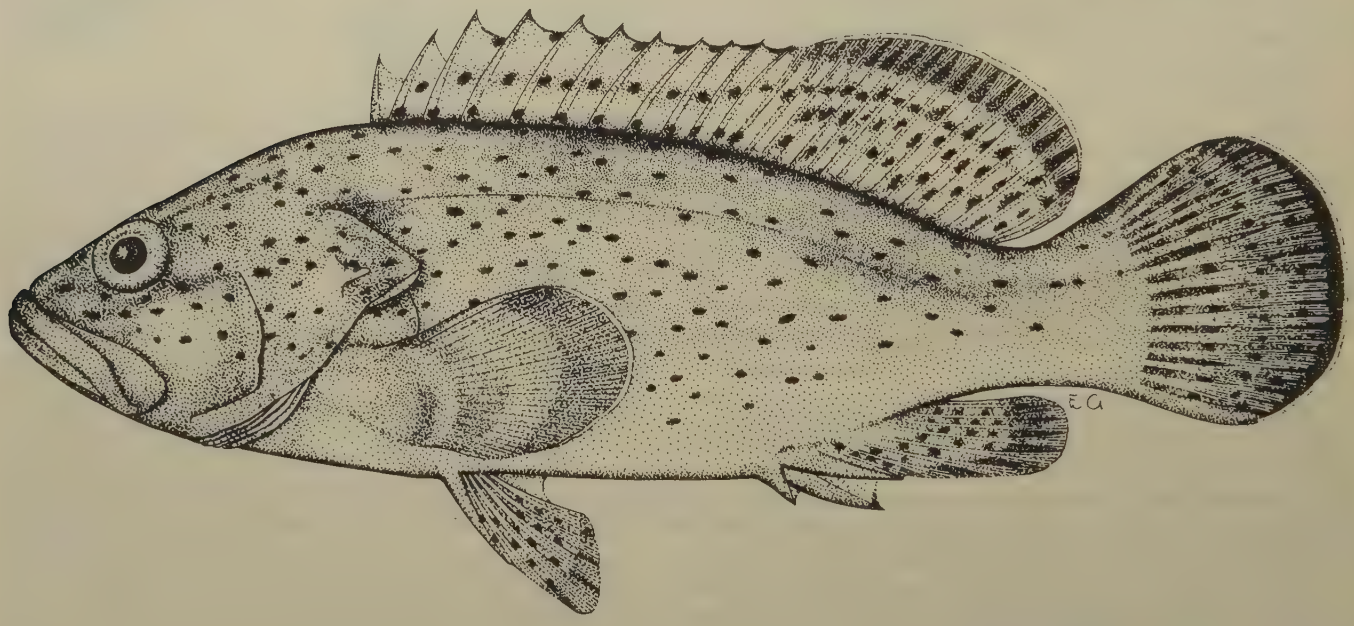


Fig. 263 ***Epinephelus bontoides***
(165 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.2 times in standard length (for fish 8 to 23 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat to slightly convex, the dorsal head profile almost straight; preopercle rounded, finely serrate, the ventral serrae slightly enlarged; upper edge of operculum straight; maxilla reaches past rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth. Gill rakers 6 to 8 on upper limb, 13 to 15 on lower limb, 21 total. Dorsal fin with XI spines 16 or 17 rays, the 3rd to 11th spines subequal and shorter than longest rays, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.6 to 2.0 times in head length; pelvic-fin length contained 1.9 to 2.3 times in head length; caudal fin rounded. Midlateral-body scales ctenoid; adults with auxiliary scales; lateral-line scales 48 to 51; lateral-scale series 82 to 86. Pyloric caeca about 18 (1 specimen). **Colour**: Head and body greyish brown, covered (except ventrally) with well-separated, dark reddish brown to black spots, smaller than pupil and many horizontally elongate; fins darker than body, the median fins with small dark spots; pectoral, soft dorsal, caudal, and sometimes anal fin dark with a narrow pale yellow or white margin; spinous dorsal fin with 3 rows of oblique black spots.

Geographical Distribution: Western Pacific: Indonesia, Philippines, Taiwan, and New Britain (Fig. 264).

Habitat and Biology: Mud or rocky/cobble bottoms in depths of 2 to 30 m. Nothing has been published on the biology of this rare species.

Size: Attains at least 30 cm total length.

Interest to Fisheries: None.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: *E. bontoides* appears to be one of the rarest groupers in the Indo-Pacific region.

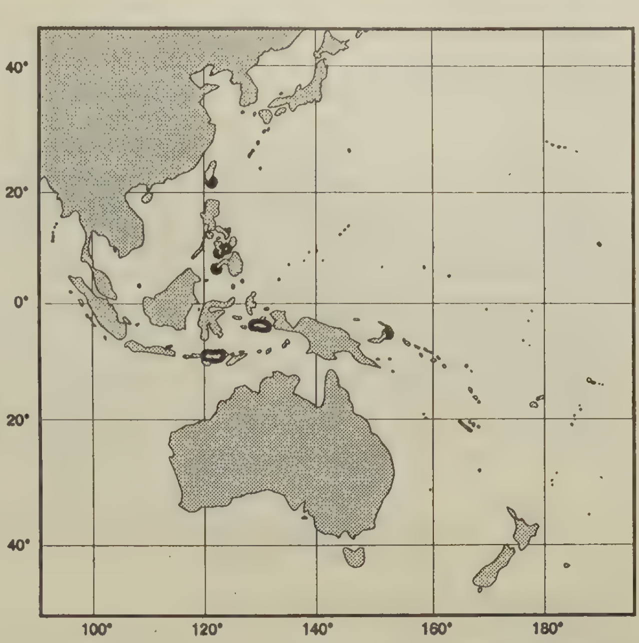


Fig. 264

Epinephelus bruneus Bloch, 1793

Fig. 265; Pl. XID,E

SERRAN Epin 7

Epinephelus bruneus Bloch, 1793:15, pl. 328, fig. 2 (type locality given erroneously as Norway).

Synonyms: *Serranus mo-ara* Temminck and Schlegel, 1842:10, pl. 4, fig. 2 (type locality: Nagasaki, Japan).

FAO Names: **En** - Longtooth grouper (formerly: Mudgrouper); **Fr** - Mérou longues dents; **Sp** - Mero diente largo.

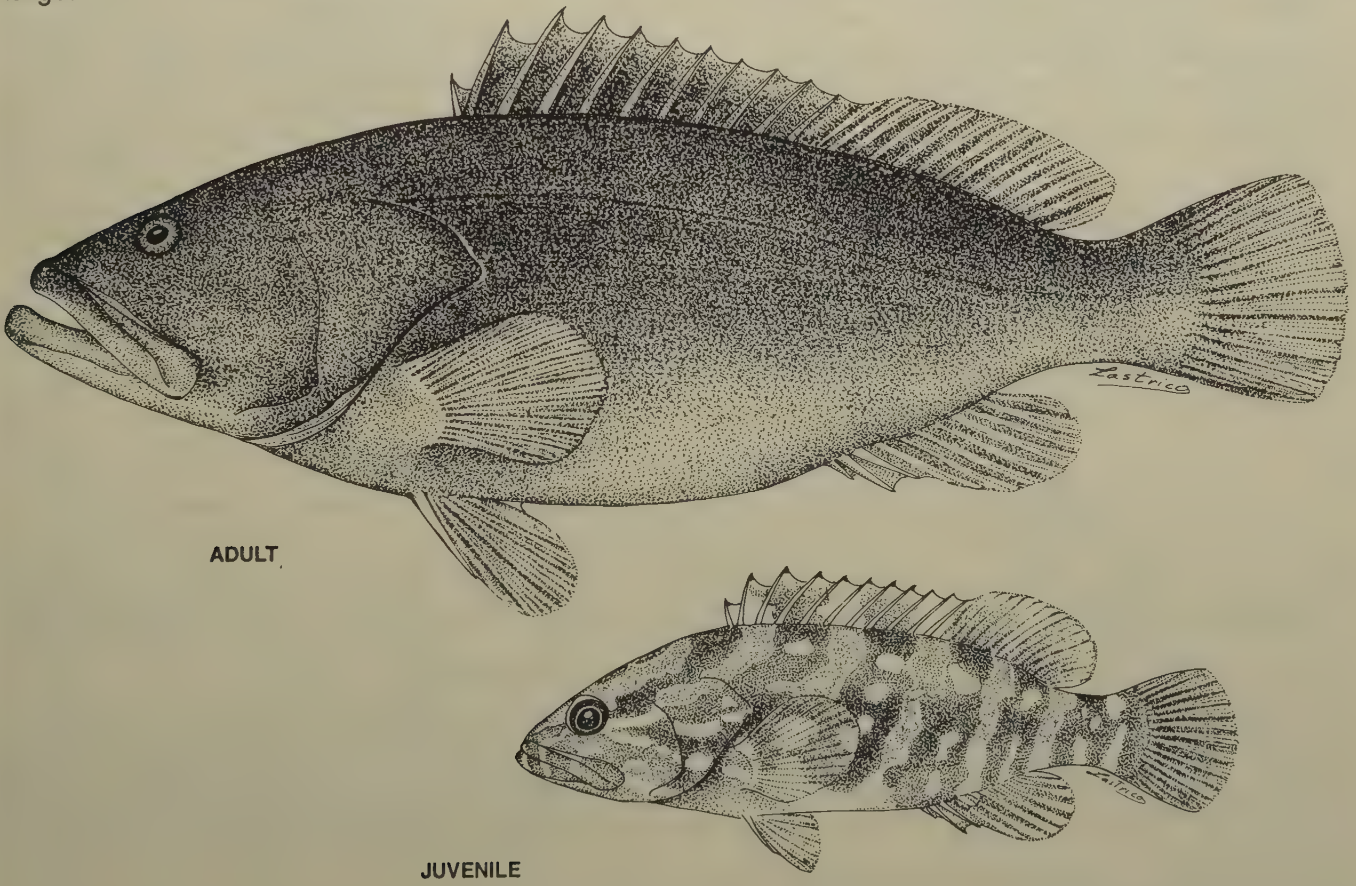


Fig. 265 *Epinephelus bruneus*
(adult 800 mm standard length, juvenile 400 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.6 times in standard length (for fish 12 to 51 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex; preopercle angular, with the serrae at angle distinctly enlarged; dorsal spine on opercle inconspicuous; upper edge of operculum convex; nostrils small subequal; maxilla reaches past vertical at rear edge of eye; tiny embedded scales on maxilla; no step on ventral edge of maxilla; midlateral part of lower jaw with 2 rows of well-developed canines, those along sides of upper jaw slightly smaller. Gill rakers shorter than gill filaments, 9 to 11 on upper limb, 16 to 18 on lower limb, total 24 to 27. Dorsal fin with XI spines and 13 to 15 rays, the third or fourth spine longest, but shorter than the longest ray, the interspinous membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.9 to 2.5 times in head length; pelvic-fin length contained 2.2 to 2.6 times in head length and ending well short of anus; caudal fin rounded. Midlateral-body scales ctenoid; no auxiliary scales on body; lateral-line scales 64 to 72; some anterior lateral-line scales on adults with branched tubes; lateral-scale series 93 to 126. **Colour**: Adults (larger than 40 cm standard length) dark greyish brown, the bars and bands replaced by faint dorsal blotches or absent altogether, the body covered with small pale grey spots forming short horizontal lines and a mottled pattern; lower margin of anal fin and lower corner of caudal fin with white edge. Juveniles pale yellowish brown, the body with 6 irregular, oblique dark bars containing irregular pale spots; first bar extends from nape to eye, the last on caudal peduncle; 3 dark brown bands radiating from lower part of eye; some fish with distal part of interspinous membranes greenish yellow.

Geographical Distribution: *E. bruneus* is known only from the coasts of Korea, Japan (north to Hegura-jima Island, 37°50'N), China (south to Hong Kong and Hainan Island), and Taiwan (Fig. 266).

Habitat and Biology: Rocky reefs and mud bottom; adults found in depths of 20 to 200 m; juveniles occur in shallow water.

Size: Maximum total length about 100 cm.

Interest to Fisheries: An excellent eating fish. In 1968, *E. bruneus* was one of the most abundant species in Hong Kong waters. It is caught with handlines, longlines, and trawls.

Local Names: HONG KONG: Mud grouper, Lai-paan (adults), Ching-paan (juveniles); JAPAN: Hue.

Literature: Chan (1968); Randall and Heemstra (1991).

Remarks: In recent literature, this species was generally identified as *Epinephelus moara*. According to Burgess and Axelrod (1971) a specimen (identified as "*Epinephelus moara*") of 134 cm and weighing about 30 kg was caught off Kochi, Japan. This record may be true, but we have seen no verification of it.

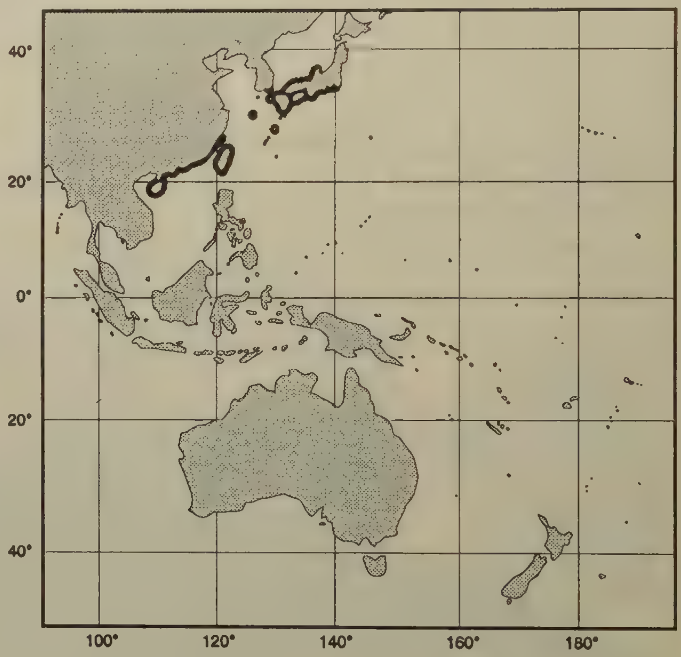


Fig. 266

Epinephelus caeruleopunctatus (Bloch, 1790)

Fig. 267; Pls IXF, XA

SERRAN Epin 28

Holocentrus caeruleo-punctatus Bloch, 1790:94, pl. 242, fig. 2 (type locality unknown).

Synonyms: *Serranus alboguttatus* Valenciennes in Cuv. and Val., 1828:366 (type locality: Indian Ocean). *Serranus dermochirus* Valenciennes in Cuv. and Val., 1830:513 (type locality: coast of Coromandel, India). *Serranus Hoevenii* Bleeker, 1849:36 (type locality: Jakarta, Indonesia). *Serranus Kunhardtii* Bleeker, 1851b:169 (type locality: Padang, Sumatera [Sumatra], Indonesia). *Serranus flavoguttatus* Peters, 1855a:429 (type locality: Mozambique).

FAO Names: En - Whitespotted grouper; **Fr** -Mérou taches blanches; **Sp** - Mero nevero.

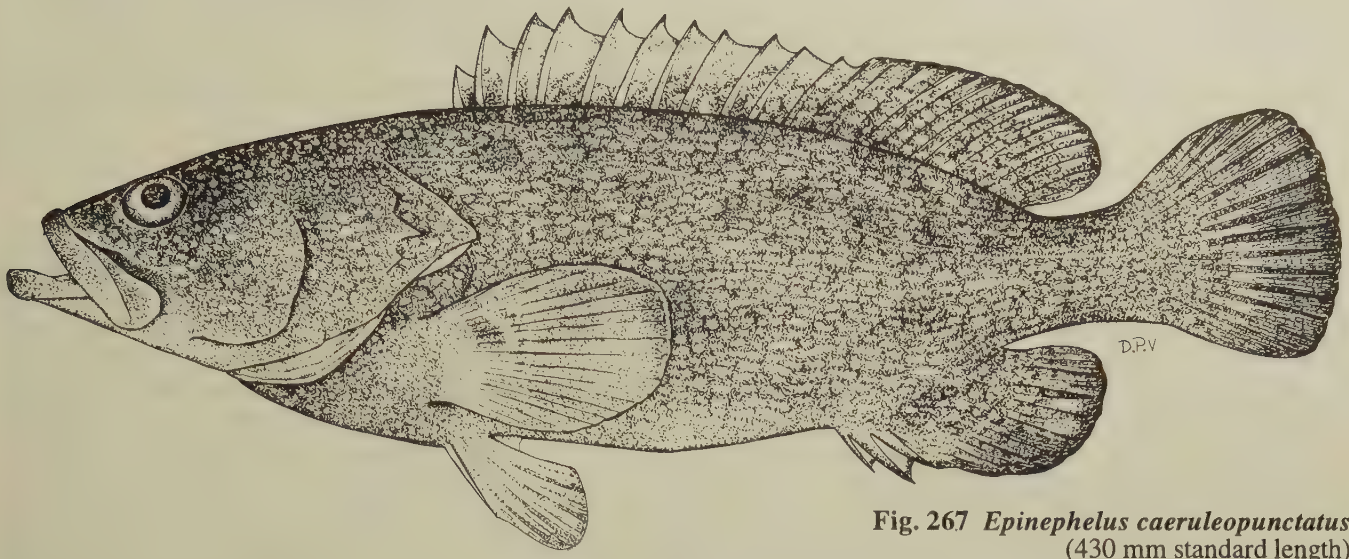


Fig. 267 *Epinephelus caeruleopunctatus* (430 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.9 to 3.4 times in standard length (for fish 11 to 47 cm standard length). Head length contained 2.3 to 2.5 times in standard length; head pointed, the interorbital area usually flat (sometimes concave or slightly convex), and the dorsal profile almost straight; preopercle rounded, finely serrate; opercular spines inconspicuous; upper edge of operculum straight, sinuous or slightly convex; in fish more than 35 cm standard length, the posterior nostril becomes vertically elongated, its length 5 or 6 times greater than diameter of front nostrils; maxilla reaches short of or slightly beyond vertical at rear edge of eye; maxilla naked, mostly covered by upper lip; canines at front of jaws small or absent; midlateral part of lower jaw with 3 to 5 rows of small teeth. Gill rakers 8 to 10 on upper limb, 13 to 17 on lower limb; fish larger than 20 cm standard length with only 4 to 8 developed rakers on lower limb, and the rudiments are difficult to count because of intercalated bony tooth plates; gill rakers shorter than gill filaments, the raker at angle of gill arch about twice as long as adjacent rakers. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.7 to 3.6 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral fins large and fleshy, with 17 to 19 rays; pectoral-fin length contained 1.5 to 2.1 times in head length; pelvic fins end well short of anus, their length contained 2.0 to 2.7 times in head length; caudal fin rounded. Lateral-body scales ctenoid (1 fish, 43 cm standard length, with "mostly smooth" lateral-body scales), with auxiliary scales; lateral-line scales 51 to 61; lateral-scale series 86 to 109. **Colour**: Adults brownish grey, the body covered with small pale spots overlain with large pale blotches; oblique black saddle on rear half of peduncle; 4 or 5 indistinct black blotches at base of dorsal fin; prominent black streak on maxillary groove. Large adults (over 40 cm standard length) brownish, covered with indistinct, contiguous, small pale spots. Juveniles (less than 20 cm standard length) dark grey to black, covered with prominent pupil-size white spots and smaller white dots.

Geographical Distribution: *E. caeruleopunctatus* is a widely-distributed species that ranges from the east coast of Africa (south to East London, South Africa) to Fiji in the central Pacific. It is not known from the Red Sea (where it is replaced by the endemic *Epinephelus summana*), but it does occur in the Persian Gulf. We have examined specimens from South Africa, Mozambique, Tanzania, Zanzibar, Kenya, Madagascar, Seychelles, Chagos Islands, India, Sri Lanka, Nicobars, Thailand, Indonesia, Philippines, Taiwan, Papua New Guinea, Australia (Queensland and New South Wales), Palau, Solomon Islands, New Caledonia, Vanuatu, Caroline Islands, Marshall Islands, Gilbert Islands (Kiribati), and Fiji. Reliable records indicate that the species is also known from Japan, Ogasawara Islands, Lakshadweep Islands, and the Maldives (Fig. 268). The record from northwestern Australia (Allen and Swainston, 1988) is doubtful; we found no specimens of *E. caeruleopunctatus* in the Western Australian Museum, but we did find a few specimens of *E. corallicola* that were misidentified as *E. caeruleopunctatus*.

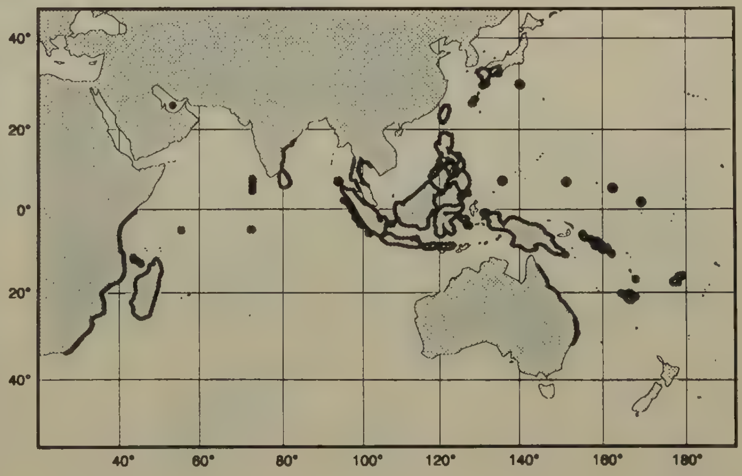


Fig. 268

Habitat and Biology: Coral reefs, usually in or near caves. Juveniles are found in tidepools.

Size: The largest specimen that we have seen is 59 cm total length (47 cm standard length). According to Grant (1982), this species attains 76 cm total length.

Interest to Fisheries: *E. caeruleopunctatus* is probably of some importance to fisheries in areas where it is common, but we have no fishery information on this species.

Local Names: JAPAN: Hakuten-hata; SEYCHELLES: Vieille cuisinier.

Literature: Randall and Heemstra (1991).

Remarks: *E. caeruleopunctatus* is closely related to (and often confused with) three other white-spotted species: *E. ongus*, *E. summana*, and *E. corallicola*. Adults of *E. ongus* also have a pattern of pale spots and blotches and a prominent black maxillary streak; but the white spots tend to form irregular longitudinal bands on the body, and the soft dorsal, caudal, and anal fins have a blackish brown margin with a narrow white edge. The juveniles (less than 15 cm standard length) have close-set, uniformly small white spots covering the body and most of the median fins; but *E. caeruleopunctatus* juveniles have scattered, prominent, irregular, white spots of various sizes, with only a few on the median fins. There are also significant meristic differences between these two species: *E. ongus* has 15 to 17 pectoral-fin rays, usually 15 dorsal-fin rays, and 48 to 53 lateral-line scales. And in *E. ongus* the upper edge of the operculum is very convex, in contrast to the nearly straight or slightly convex margin of *E. caeruleopunctatus*. *E. summana* has the body and median fins dark brown or brownish grey, covered with very small white spots; superimposed on the body are several pale brown blotches. *E. summana* also has fewer dorsal- and pectoral-fin rays (14 to 16 and 16 to 18 respectively) and lateral-line scales (49 to 54). The shape of the upper edge of the operculum is intermediate between *E. caeruleopunctatus* and *E. ongus*. Adults of *E. corallicola* do not have white spots, but the juveniles have large, prominent, black-edged white spots. In addition to colour pattern, *E. corallicola* also differs in having the rear nostrils noticeably elongated at a smaller size (15 cm standard length, versus 35 cm standard length in *E. caeruleopunctatus*). The morphometric and meristic features of these two species are very similar, and the "gestalt" (ignoring the colour pattern) of these two species is identical.

Epinephelus caninus (Valenciennes, 1843) Fig. 269 SERRAN Epin 23

Serranus caninus Valenciennes, 1843:10 (type locality: Canary Islands; holotype apparently not preserved).

Synonyms: None.

FAO Names: **En** - Dogtooth grouper; **Fr** - Mérou gris; **Sp** - Mero dentón (formerly: Cherne dentón).

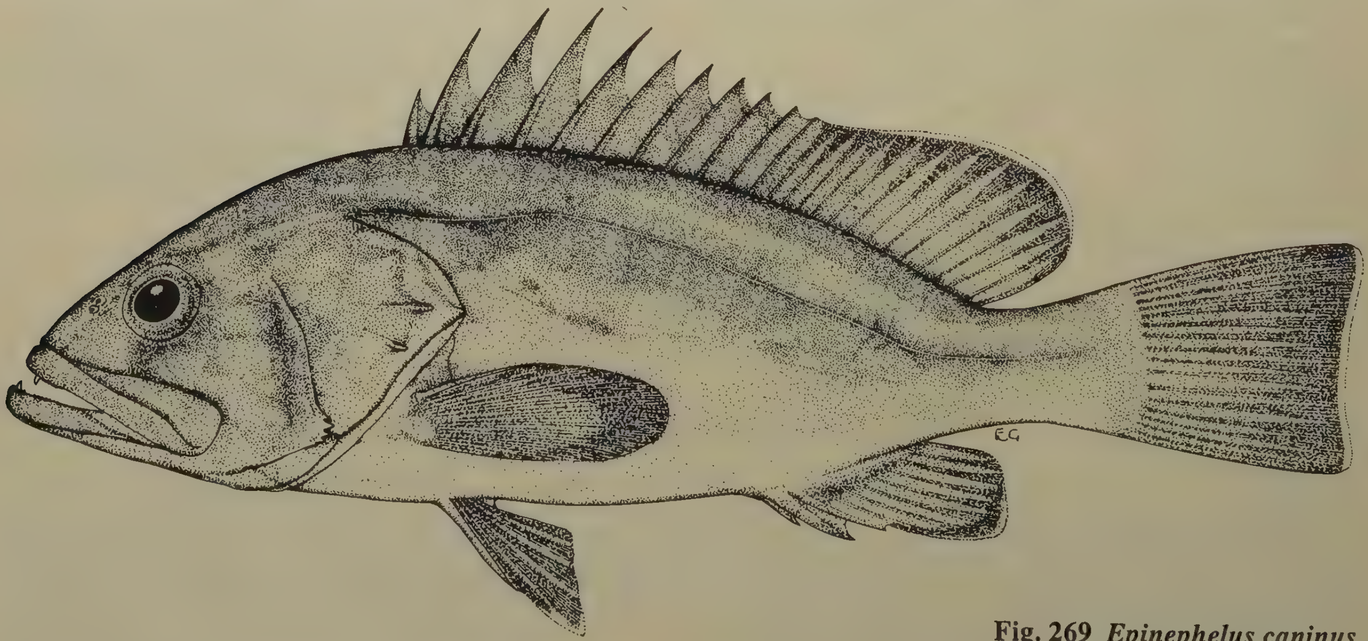


Fig. 269 ***Epinephelus caninus***
(497 mm standard length)

Diagnostic Features: Body depth 2.7 to 3.0 times in standard length (for fish 20 to 78 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex; preopercle angular, with 3 to 5 distinctly enlarged serrae at the angle and usually a slender, antrorse or ventrally-directed spine on ventral edge near the angle; subopercle and interopercle serrate; upper edge of operculum distinctly convex; eye diameter more than interorbital width in fish less than 30 cm standard length, but noticeably less than interorbital in fish more than 45 cm standard length; rear nostril 2 or 3 times size of front nostrils; maxilla scaly, reaching to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth, the inner teeth larger; canines at front of jaws well developed. Gill rakers 8 to 10 on upper limb and 15 to 17 on lower limb, total 23 to 27. Dorsal fin with XI spines and 13 or 14 rays, the membranes deeply incised between the spines; anal fin with III spines and 8 rays; pectoral fins with 17 or 18 rays, distinctly longer than pelvic fins, pectoral-fin length contained 1.7 to 2.2 times in head length; pelvic fins clearly not reaching anus; caudal fin truncate, the corners slightly rounded. Body scales distinctly ctenoid; lateral-line scales 70 to 79; lateral-scale series about 120 to 135. **Colour**: Uniformly dark reddish brown or greyish violet to yellowish grey; posterior parts of median fins with a distinct white edge. Usually two or three dark bands radiating posteriorly from the eye, the uppermost extends from eye to lower opercular spine, the second runs from lower edge of eye across angle of preopercle to juncture of interopercle and subopercle, and the third band (usually the faintest) extends from the dark moustache streak at the upper edge of the maxilla to the lower edge of the preopercle. The dark bands on the head are not discernible in fish larger than 45 cm standard length. A good colour photograph was published by Manzoni (1987). The illustration in Seret's (1981) book is also a good likeness.

Geographical Distribution: Mediterranean and eastern Atlantic from Portugal to Angola; we have examined specimens from Sicily, Israel, Senegal, Togo, and Angola. Dooley et al. (1985) reported that it is rare in the Canaries (Fig. 270)

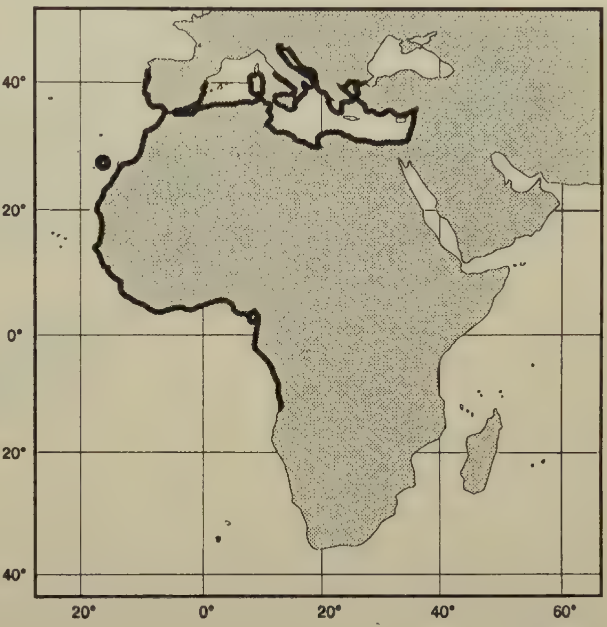


Fig. 270

Habitat and Biology: *E. caninus* occurs on sandy mud bottoms in depths of 30 to 400 m. An age and growth curve for Tunisian specimens was published by Bouain (1986).

Size: Maximum 157 cm total length, and at least 35 kg.

Interest to Fisheries: *E. caninus* is of commercial importance in the Mediterranean and along the west coast of Africa; it is common in the fish markets of Dakar, Senegal.

Local Names: BENIN: Mérou noir; CAMEROON: Mérou noir; CONGO: Mérou noir; COTE D'IVOIRE: Mérou noir; GABON: Mérou noir; ITALY: Cernia nera; MAURITANIA: Mérou noir; SENEGAL: Cherne, Ngaingo, Rour; SPAIN (Canaries): Cachorro, Cherne ley; TOGO: Mérou noir; TUNISIA: Mérou noir; ZAIRE: Mérou noir.

Literature: Cadenat (1935, 1951); Furnestin et al. (1958); Maurin (1968); Tortenese (1975, 1986); Bauchot (1987); Bellemans et al. (1988); Heemstra (1991).

Remarks: *E. caninus* is similar to *E. goreensis*, which has 16 dorsal-fin rays, a smaller head (its length contained 2.5 to 2.7 times in standard length), and the upper edge of the operculum is almost straight. Another similar species, *E. haifensis*, has a rounded caudal fin, 9 anal-fin rays, body depth usually greater (depth contained 2.4 or 2.8 times in standard length), pelvic fins subequal to pectoral fins and reaching to or beyond the anus, no scales on maxilla, and fewer lateral-scale series (104 to 112). *E. costae* has a more elongate body (depth contained 3.0 to 3.4 times in standard length), smaller head (head length contained 2.5 to 2.7 times in standard length), 15 to 17 dorsal-fin rays, and no scales on the maxilla. *E. marginatus* differs in having a rounded caudal fin, 14 to 16 dorsal-fin rays, no scales on maxilla, and 98 to 116 lateral-scale series. The 78 cm standard length specimen from Angola described by Franca (1957) under the name of "*Epinephelus* sp.— B2" was examined at the Museu Bocage; it appears to be *E. caninus*. The species described and illustrated as "*Epinephelus alexandrinus*" by Poll (1954:56, fig. 15) is probably *E. caninus.*

Epinephelus chabaudi (Castlenau, 1861)

Fig. 271; Pl. XB

SERRAN Epin 43

Serranus Chabaudi Castlenau, 1861:3 (type locality: Algoa Bay, South Africa).

Synonyms: ***Epinephelus modestus*** Gilchrist and Thompson, 1909:218 (type locality: Durban [a market specimen probably taken south of Durban]). ***Epinephelus clarkei*** Smith, 1958:123, pl. 1, fig. C (type locality: off mouth of Xora River, Transkei, South Africa).

FAO Names: **En** - Moustache grouper; **Fr** - Mérou moustache; **Sp** - Mero bigotudo.

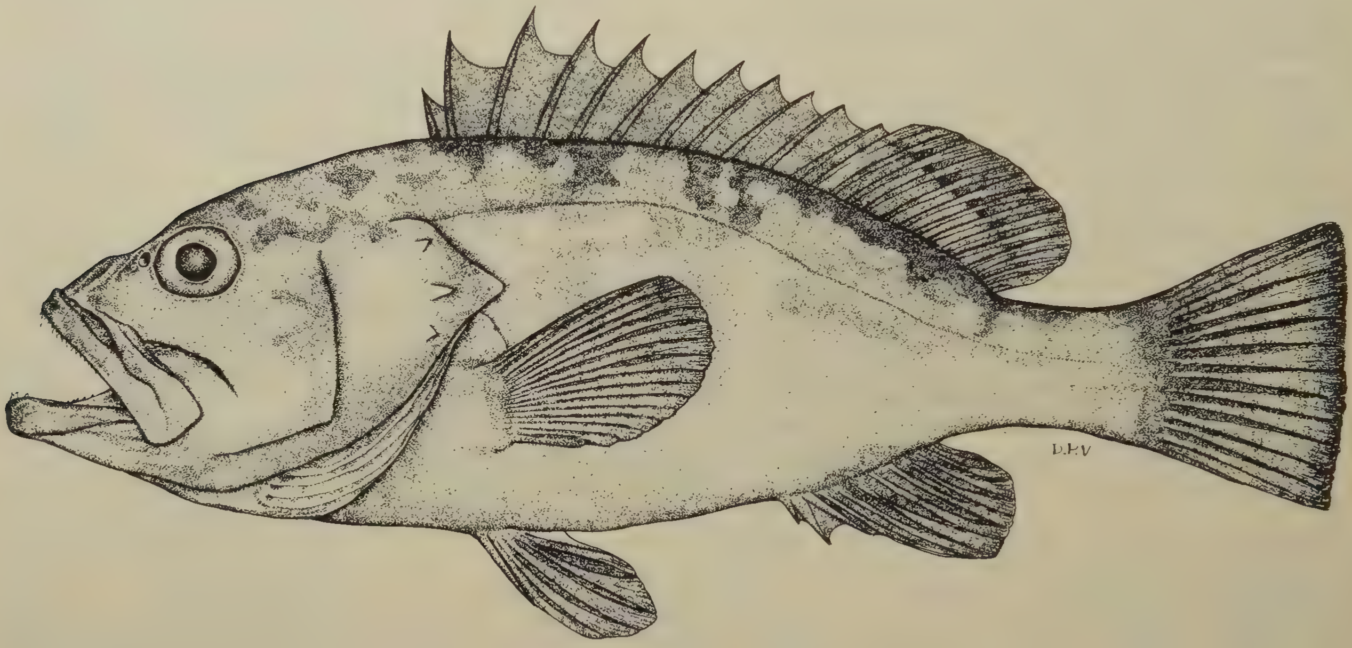


Fig. 271 ***Epinephelus chabaudi***
(239 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 2.8 times in standard length (for fish 20 to 56 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex; preopercle angular, the serrae at angle enlarged and on some specimens they continue onto posterior part of lower limb; upper edge of operculum convex; diameter of posterior nostrils 2 to 4 times larger than anterior nostrils; maxilla scaly, reaching to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth in fish 20 to 56 cm standard length and 3 or 4 rows in fish 70 to 90 cm standard length. Gill rakers 8 or 9 on upper limb, 15 to 17 on lower limb, total 22 to 25. Dorsal fin with XI spines and 13 or 14 rays, the third or fourth spine longest and usually slightly longer than longest ray, the interspinous membranes deeply incised; anal fin with III spines and 9 (rarely 8) rays; pectoral-fin rays 17 to 18; pectoral-fin length contained 1.7 to 2.0 times in standard length; pelvic fins not reaching anus, their length contained 1.9 to 2.4 times in standard length; caudal fin truncate. Lateral-body scales ctenoid; auxiliary scales sparse or absent on body scales; lateral-line scales 61 to 69; lateral-scale series 100 to 114. **Colour**: Fresh specimen, 33 cm standard length: head and body greyish brown, shading to pale purplish grey ventrally, with 3 broad dark bars between dorsal fin and lateral line, continuing faintly below lateral line; broad dark blotch dorsally on caudal peduncle, reaching about halfway to lateral line; nape and dorsal part of head faintly yellowish; prominent dark brown streak along edge of maxillary groove; fins greyish brown, the tips of spinous dorsal-fin membranes dark reddish brown; rays of median and pelvic fins paler than membranes; pectoral-fin rays brown, the membranes pale. Colour of fresh specimens, 88 to 115 cm standard length from deep water off Kenya (Morgans, 1982): rosy slate or chocolate brown; throat and hidden membranes of head pinkish grey; eye nondescript silvery; no bars, spots, blotches, marginal coloured bands, or conspicuous moustache streak.

Geographical Distribution: *E. chabaudi* is known from the east coast of Africa (from Kenya to Knysna, South Africa, 34°3'S) and the Kerala coast of India; however, there are no records between Kenya and Durban, and none between Kenya and India (Fig. 272). The record from Djibouti (Bouhlel, 1988, identified as *E. modestus*) is doubtful; the lower figure is a photograph of *E. summana*, and the count of 15 dorsal-fin rays is not known for *E. chabaudi*.

Habitat and Biology: Along the coast of South Africa, *E. chabaudi* occurs on rocky bottom at depths of 9 to at least 55 m, but it is less common than *E. marginatus*; and juveniles have not been found in tidepools. Off the coast of Kenya, *E. chabaudi* occurs below the major thermocline at depths of 125 to 200 m (Morgans, 1982; Randall and Heemstra, 1991). It is also known only from deep water (250 to 300 m) off the Kerala coast of India (Talwar and Kacker, 1984). The presence of this species off the coasts of Kenya and India appears to be an example of "tropical submergence" by which temperate species are able to live at tropical latitudes only in the cooler deep-water zone.

Size: Attains at least 137 cm total length and 40.8 kg (Morgans, 1982).

Interest to Fisheries: According to Talwar and Kacker (1984), *E. chabaudi* (identified as "*Epinephelus modestus*") is "quite common in the trawl catches off the Kerala coast at a depth of about 250 to 300 m." Probably of some interest to sport and commercial hook-and-line fisheries in South Africa.

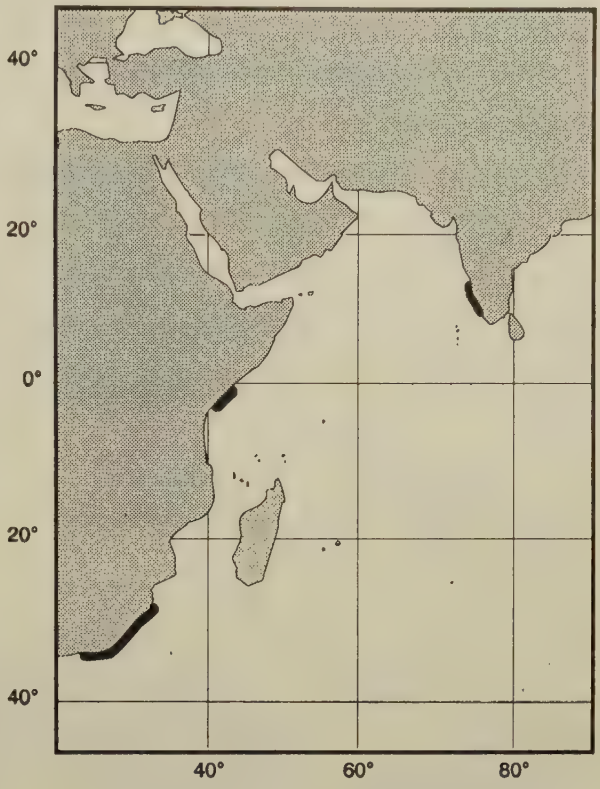


Fig. 272

Local Names:

Literature: Morgans (1982); Randall and Heemstra (1991).

Remarks: We found 9 anal-fin rays on the holotype of *E. clarkei*, not 8 as given by Smith (1958). We also disagree with Smith (1958:125) that "This species is closely related to *E. morrhua* Valenciennes, 1833 ..."; we believe that *E. chabaudi* is closely related to *E. septemfasciatus* (see remarks of this species). Smith (1958) remarked of *E. clarkei* (his "new species"): "This fish is in some ways a surprising discovery, since it is apparently a not uncommon capture on lines in 5 to 30 fathoms off the coast between Bashee and Durban (30° to 33°S) and must often have appeared among fishes sold in Durban." In fact, this species was previously described by Gilchrist and Thompson (1909, as *Epinephelus modestus*) based on a specimen from the Durban market! Although we have not examined any specimens from India, the record of Talwar and Kacker (1984, as *E. modestus*) from the Kerala coast does seem to be *E. chabaudi*.

Epinephelus chlorocephalus (Valenciennes, 1830)

Fig. 273

SERRAN Epin 65

Serranus chlorocephalus Valenciennes in Cuv. and Val., 1830:522 (type locality: Tongatapu, Tonga).

Synonyms: None.

FAO Names: **En** - Tonga grouper; **Fr** - Mérou tonga; **Sp** - Mero Tonga.

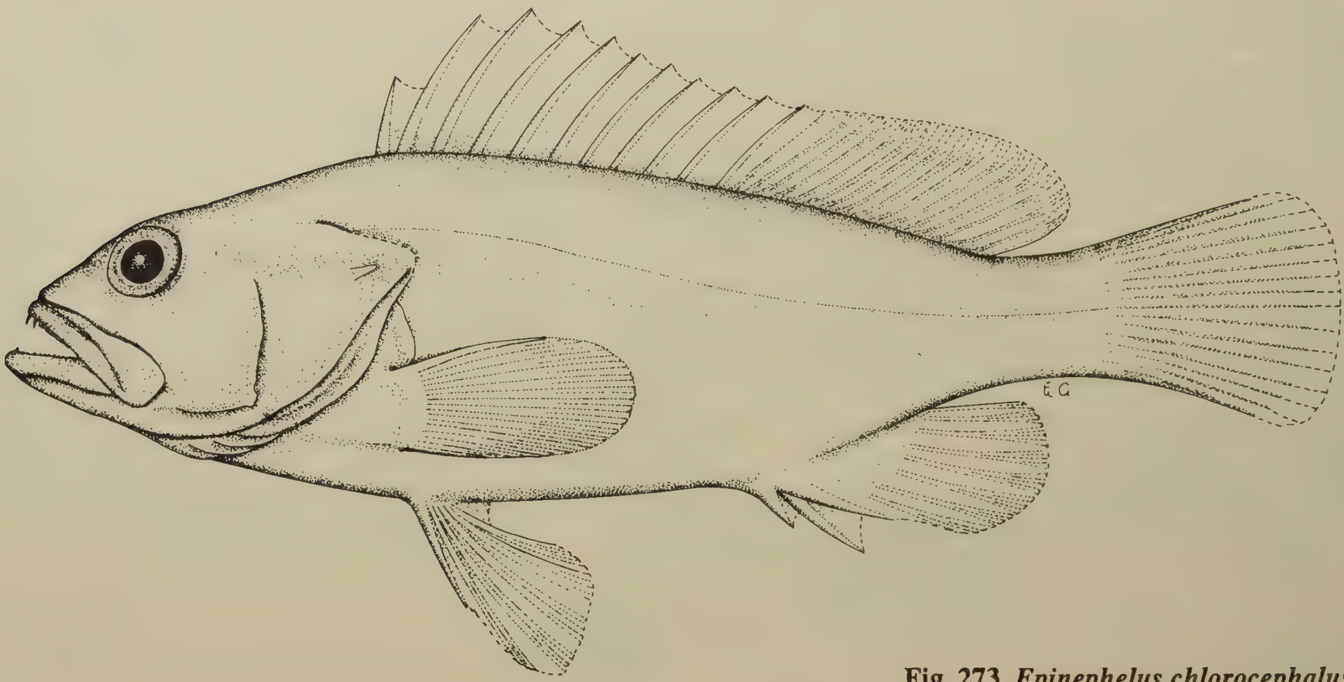


Fig. 273 ***Epinephelus chlorocephalus***
(171 mm standard length)

Diagnostic Features: Body depth contained 3.4 times in standard length (1 specimen known, 171 mm standard length). Head length contained 2.6 times in standard length. Head pointed, the interorbital area flat, and the dorsal profile slightly convex; preopercle subangular, with 5 distinctly enlarged serrae at the angle; upper edge of operculum straight; maxilla not reaching past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 on upper limb and 15 on lower limb. Dorsal fin with XI spines and 17 rays, the fourth spine longest, its length contained 2.45 times in head length; anal fin with III spines and 8 rays; pectoral fins with 18 rays; pectoral-fin length contained 1.75 times in head length; pelvic fins not reaching anus, their length contained 1.9 times in head length; caudal fin rounded. Lateral-body scales ctenoid; lateral-line scales 52 to 54. Second supraneural bone curved, shaped like the suture needle used by surgeons. **Colour**: (Colour description translated from Valenciennes, who presumably took it from notes of Quoy and Gaimard.) Dorsal part of head and snout green, the cheeks pale green;body greenish with 7 to 8 alternating stripes of greenish brown and yellow-orange; dorsal and anal fins greenish, spotted with reddish brown at base; paired fins light greenish without spots; caudal fin greenish with faint reddish bars. The colour pattern of the holotype is now completely faded.

Geographical Distribution: *E. chlorocephalus* is known only from the Tonga Islands (Fig. 274).

Habitat and Biology: Unknown.

Size: The only known specimen is 17 cm standard length.

Interest to Fisheries: None.

Local Names:

Literature: Randall and Heemstra (1991).

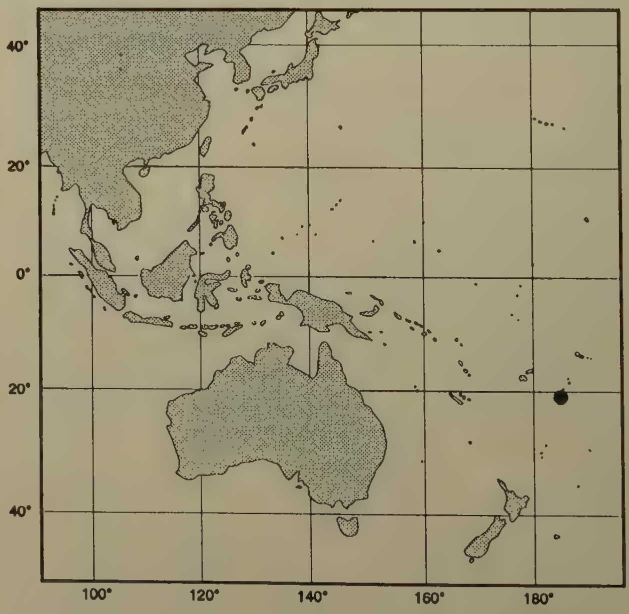


Fig. 274

Remarks: The absence of additional specimens of *E. chlorocephalus* is puzzling.

Epinephelus chlorostigma (Valenciennes, 1828) Fig. 275; Pl. XC SERRAN Epin 29

Serranus chlorostigma Valenciennes in Cuv. and Val., 1828:352 (type locality: Seychelles).

Synonyms: ***Serranus areolatus japonicus*** Temminck and Schlegel, 1842:8 (type locality: Japan). ***Serranus tauvina*** (non Forsskål): Geoffroy Saint-Hilaire, 1809:pl. 20, fig. 1 (Suez). ***Serranus reevesii*** Richardson, 1846:232 (type locality: Canton, China = Guangzhou; based on a painting by John Reeves). ***Serranus Geoffroyi*** Klunzinger, 1870:675 (footnote; based on ***S. tauvina*** [non Forsskål]: Geoffroy Saint-Hilaire). ?***Serranus celebicus*** var. ***multipunctatus*** Kossman and Räuber, 1877:6 (type locality: Red Sea). ***Serranus assabensis*** Giglioli, 1888:68 (type locality: Assab, Ethiopia).

FAO Names: **En** - Brownspotted grouper; **Fr** - Mérou pintade; **Sp** - Mero pintado.

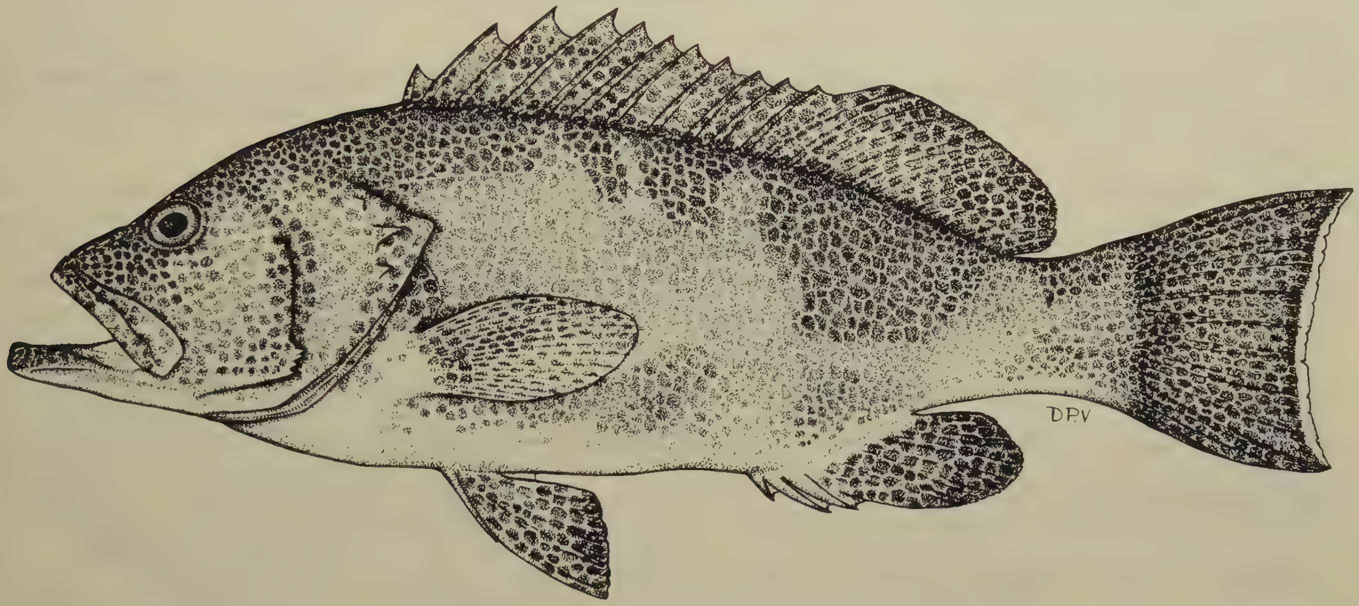


Fig. 275 ***Epinephelus chlorostigma***
(320 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 12 to 51 cm standard length); body width contained 1.8 to 2.2 times in the depth. Head length contained 2.4 to 2.7 times in standard length; interorbital slightly convex; preopercle angular, with 4 to 7 enlarged serrae at angle; upper edge of operculum straight; posterior nostrils not noticeably larger than anterior nostrils; maxilla reaches about to vertical at rear edge of eye; maxilla scaly, with a low step on posterior part of ventral edge; midlateral part of lower jaw with 2 to 4 rows of teeth, the inner ones about twice the size of outer teeth. Gill rakers 8 to 11 on upper limb, 15 to 18 on lower limb, 23 to 29 total; gill rakers longer than gill filaments. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest, its length contained 2.4 to 3.2 times in head length, the interspinous membranes slightly to moderately incised; anal fin rounded or angular, with III spines and 8 rays, the third spine longer than second; pectoral-fin rays 17 to 19; pectoral fins usually slightly longer than pelvic fins, pectoral-fin length contained 1.6 to 2.0 times in head length; pelvic-fin length contained 1.8 to 2.3 times in head length; caudal-peduncle depth contained 3.0 to 3.6 times in head length; caudal fin truncate or slightly emarginate. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 53; lateral-scale series 96 to 122. Pyloric caeca 26 to 52. **Colour**: Head, body, and fins with small, irregular, close-set dark brown spots, the ground colour forming a pale network; caudal fin usually with a white line along rear margin; spots on pectoral fins mainly confined to rays.

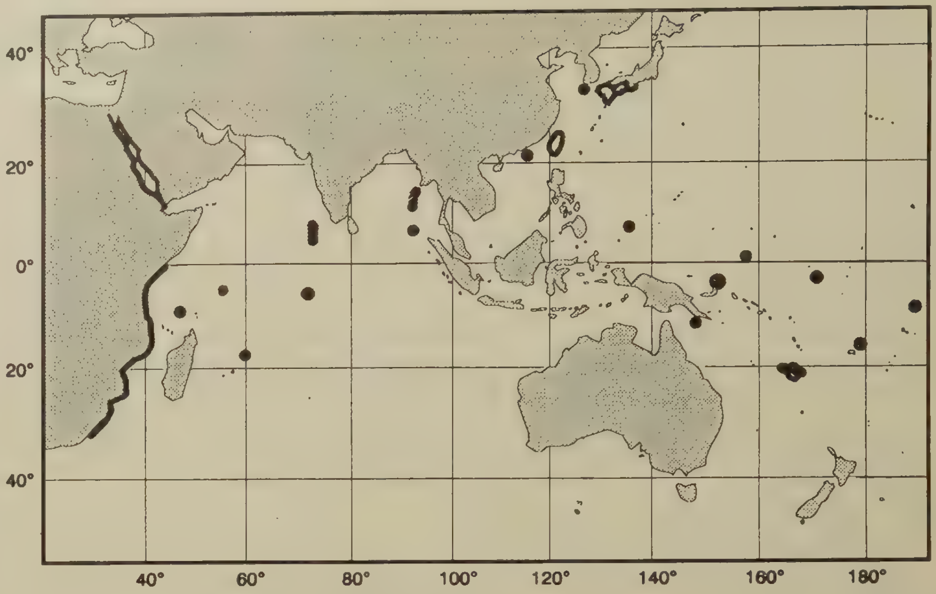


Fig. 276

Geographical Distribution: *E. chlorostigma* occurs from the Red Sea and east coast of Africa (south to Natal, South Africa) to the western Pacific (from southern Japan to New Caledonia); confirmed records also include the western Gulf of Aden (Djibouti and Aden), Kenya, Tanzania, Seychelles, Chagos Islands, Maldives, Lakshadweep Islands, Andaman Islands, Nicobar Islands, Viet Nam, China, Hong Kong, Korea, Papua New Guinea, New Ireland, Caroline Islands, American Samoa, and Fiji (Fig. 276). The wide distribution of *E. chlorostigma* has some puzzling gaps. There are no verifiable records from the Comoros, the continental shelf between Oman and Cambodia, Indonesia, Philippines, Taiwan, and Australia. Records from the Persian Gulf (Randall et al., 1978; Kuronuma and Abe, 1986) are apparently misidentifications of *E. polylepis*.

Habitat and Biology: This species is found on coral reefs and also (in the South China Sea) on mud bottoms. The depth range is 4 to 280 m. According to Morgans (1982), maturity is attained at about 25 cm standard length. *E. chlorostigma* feeds on fishes and crustaceans (mainly stomatopods and crabs). Reproduction of *E. chlorostigma* at the Seychelles was studied by de Moussac (1986): females are mature at 23 to 29 cm total length, and sexual transition occurs between 35 and 45 cm, but all females do not change sex.

Size: Attains at least 75 cm total length and a weight of 7 kg.

Interest to Fisheries: An excellent food fish. Common in the markets of Singapore and Hong Kong.

Local Names: HONG KONG: Yuen-may-tsee-mah-paan; JAPAN: Hôsekihåta; NEW CALEDONIA: Loche pintade; SEYCHELLES: Vieille maconde; SINGAPORE: Kerapu minyak.

Literature: Morgans (1982); Randall and Heemstra (1991).

Remarks: The *Epinephelus chlorostigma* species-complex comprises 3 closely-related species that are characterized by their truncate or emarginate caudal fin, colour pattern of small close-set dark brown spots covering all but ventral parts of head and body and all of the fins, preopercle subangular with serrae not much enlarged at the angle, gill arches with numerous small platelets, operculum with a straight upper edge, and 2 rows of teeth on sides of lower jaw. The other two species of this complex, *E. gabriellae* and *E. polylepis*, were described as new species by Randall and Heemstra (1991). These two species seem to replace *E. chlorostigma* in the northwestern Indian Ocean (including the Persian Gulf).

E. gabriellae has fewer dorsal-fin rays (14 or 15), more elongate body (depth contained 3.2 to 3.6 times in standard length), more slender caudal peduncle (peduncle depth contained 3.5 to 3.9 times in head length) and slight differences in colour pattern (margins of soft dorsal and anal fins and upper and lower margins of caudal fin with white edge; pectoral fins spotted only basally).

E. polylepis has smaller, more numerous scales (lateral-line 65 to 72, lateral-scale series 126 to 137) and a more rounded anal fin in adults (second or third spine longest, its length contained 2.1 to 2.5 times in head length).

Epinephelus cifuentesi Lavenberg and Grove, sp.nov. Fig. 277 SERRAN Epin 61

Epinephelus cifuentesi Lavenberg and Grove, sp. nov. (type locality: off Punta Judas, Puntarenas Province, Costa Rica).

Holotype: LACM 44418-1, 354 mm standard length; Costa Rica, off Punta Judas, Puntarenas Province; benthic trawl, depth 135 m; 28 October 1985; H. Araya-Umana, collector; M/V Gallo Pinto, Captain Antonio Lopez-Morales.

Paratypes: CAS 39423, 31.5 mm standard length; Galapagos, Santa Cruz Island, Academy Bay;1962. CAS-SU 37462, 73 mm standard length; Isla del Coco, off Isla Nuez; trawl, depth 55 to 90 m; 13 January 1938; R/V *Velero* III, sta. 773-38. UCR 720-5, 148 mm standard length; Isla del Coco, 0.8 mi NNW Pta. Gissler, 5°33'N, 87°04'W; depth 9 m; trawl, depth 110 m; 3 April 1972; R/V *Searcher*. UCR 1978-1, 237 mm standard length; Costa Rica, Puntarenas Province, Playa Hermosa, south of Jaco, 9°30'N, 84°39'W; 15 November 1987; R/V *Fridtjof Nansen*, sta. 931, 932. UCR 1666-2, 241 mm standard length; Costa Rica, Playas del Coco; hook-and-line; November, 1983; H. Araya, collector. UCR 1819-1, 285 mm standard length; Costa Rica, Puntarenas Province, off Playa Naranjo; benthic trawl, depth 120 m; 28 October 1985; H. Araya, collector; M/V *Gallo Pinto*. UCR 2017-1, 5 (322-588 mm standard length); Costa Rica, off Quepos. AMNH 55725, 398 mm standard length; Galapagos, North Seymour Island; Tito Rodriguez P., collector; 8 October 1982. LACM 35469-25, 501 mm standard length; Costa Rica, Isla del Coco, Wafer Bay.

Synonyms: None.

FAO Names: **En** - Olive grouper; **Fr** - Mérou poule; **Sp** - Gallina.

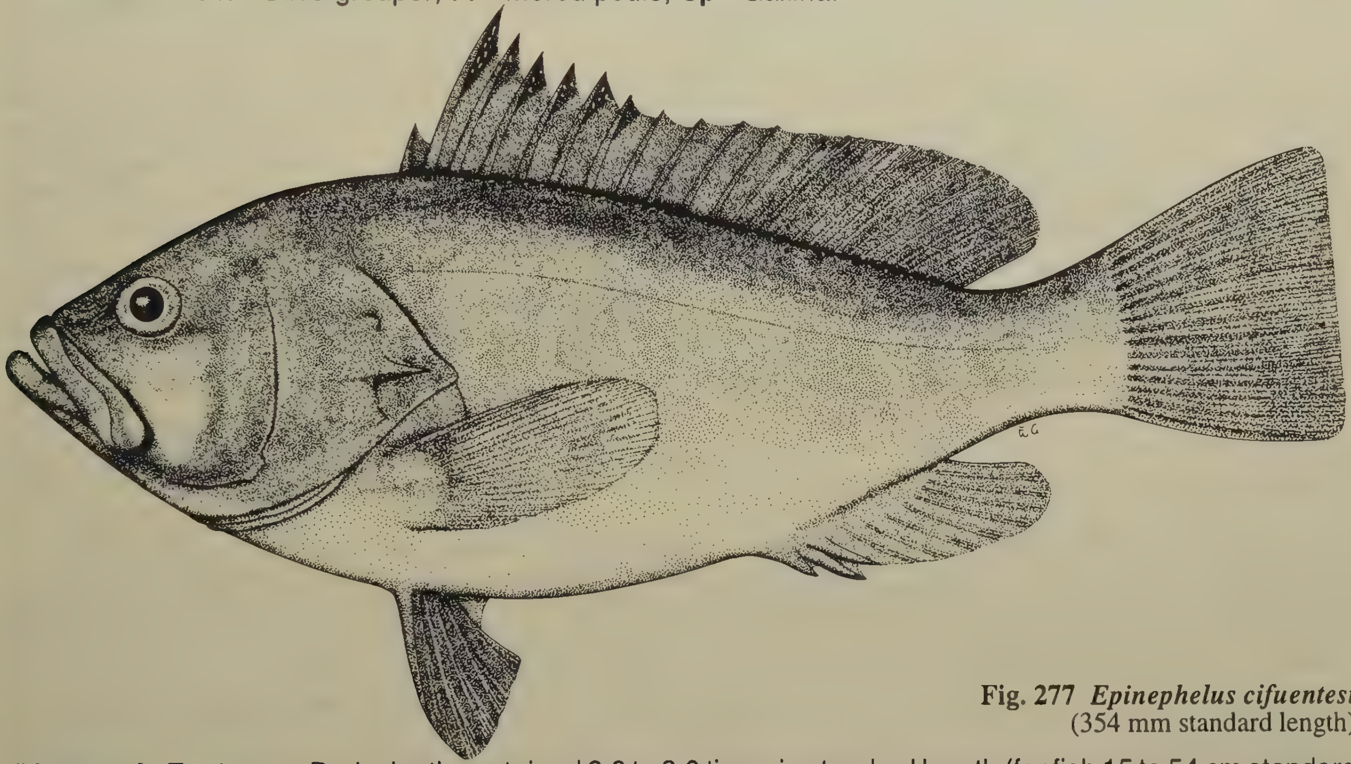


Fig. 277 *Epinephelus cifuentesi*
(354 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 3.0 times in standard length (for fish 15 to 54 cm standard length). Head length contained 2.5 to 2.8 times in standard length; interorbital area convex, the width greater than eye diameter for fish larger than 23 cm standard length; preopercle subangular, the serrae at angle slightly enlarged; upper edge of operculum slightly convex; nostrils subequal or rear nostril slightly larger; maxilla reaches past vertical through centre of eye; two rows of teeth at midside of lower jaw. Gill rakers 9 to 11 on upper limb, 17 to 20 on lower limb, total 27 to 31. Dorsal fin with XI spines and 14 to 16 rays, the second spine longest and the interspinous membranes distinctly incised; anal fin with III spines and 9 rays; pectoral-fin rays 17 to 19, the fin length contained 1.7 to 1.9 times in head length; pelvic-fin length contained 2.0 to 2.3 times in head length, pelvic-fin origin slightly in front of lower end of pectoral-fin base; caudal fin truncate with rounded corners in adults, convex in juveniles. Midlateral-body scales distinctly ctenoid, with auxiliary scales in large adults; lateral-line scales 71 to 76; lateral-scale series 131 to 144. **Colour**: When fresh, body and head pale brown, with a distinct greenish sheen on body; lips, tip of lower jaw, and dorsal part of head darker. Fins brown, generally darker than body, with a blue-green sheen, particularly evident on pectoral fins, which are cream coloured distally; pelvic fins pale brown with dusky membranes; dorsal fin dusky distally in fish 57 to 61 cm total length, the margin between first to fifth spines nearly black in fish 33 to 43 cm total length. Anal fin dusky distally with white edge (in fish 33 to 62 cm total length). Juveniles (15 cm standard length) have no distinctive markings except for a dark maxillary groove.

Geographical Distribution: Eastern Pacific: Galapagos Islands, Isla del Coco, and off Costa Rica. Probably also occurs off Mexico (see below) (Fig. 278).

Habitat and Biology: *E. cifuentesi* is known from depths of 40 to at least 120 m.

Size: In the Galapagos, this species grows to a length of about 100 cm total length.

Interest to Fisheries: *E. cifuentesi* is of great importance in the fishery at the Galapagos Islands (Reck, 1986), where they are caught mainly at the northern islands (hence the local name "norteño"). Caught with hook-and-line and in trawls.

Local Names: ECUADOR: Norteño (Galapagos); MEXICO: Gallina.

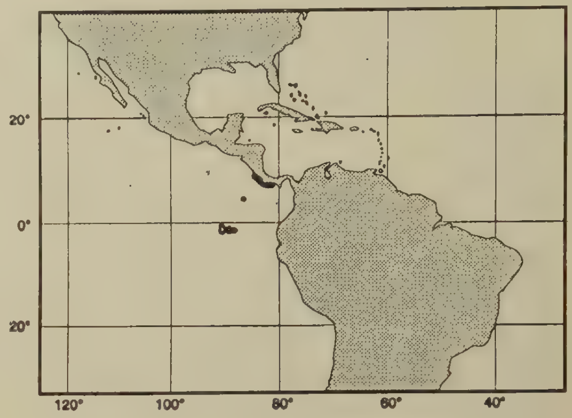


Fig. 278

Remarks: The description of this new species is taken from the unpublished manuscript of R.J. Lavenberg and J. Grove. Unfortunately, the publication of this manuscript has been delayed, and we have included the species here because of its importance in the commercial fishery of the Galapagos. The species name is in honour of Sr. Miguel Cifuentes, former Intendente of the Galapagos National Park in appreciation of his assistance in the field work at the Galapagos Islands. Although *E. cifuentesi* has only now been described and given a scientific name, it has been known to fishermen at the Galapagos for many years, and it is one of the most important commercial species there.

E. cifuentesi is readily distinguished from other eastern Pacific species of *Epinephelus*. It is most similar to *E. niphobles*, from which it differs in lacking the enlarged posterior nostrils, in having more lateral-scale series (100 to 106 in *E. niphobles*) and more gill rakers (23 to 26 in *E. niphobles*), and in the colour pattern of juveniles. *E. exsul*, differs from *E. cifuentesi* in having a dorsal fin with X spines and 13 or 14 rays, anal-fin rays 8, a larger head (head length 2.2 to 2.3 in standard length), greater body depth (the depth 2.3 in standard length), and lower scale counts (lateral line 64 to 68, lateral-scale series 87 to 92).

On page 200 of the *Catalogo de Peces Marinos Mexicanos* published by the Mexican Instituto Nacional de Pesca in 1976 is a photograph of a 236 mm total length fish identified as "Gallina (*Epinephelus* sp.)". This fish appears to be *E. cifuentesi*; the second dorsal-fin spine is the longest, and the fin counts (taken from the photograph) are XI spines and 16 rays in the dorsal fin, III spines and 9 rays in the anal fin.

Epinephelus coioides (Hamilton, 1822)

Fig. 279; Pl. XD

SERRAN Epin 67

Bola? coioides Hamilton, 1822:82 (type locality: Ganges estuaries, India).

Synonyms: *Serranus nebulosus* Valenciennes in Cuv. and Val., 1828:313 (type locality: unknown). *Serranus suillus* Valenciennes in Cuv. and Val., 1828:335 (type locality: Coromandel coast of India). *Homalogrystes Guntheri* Alleyne and Macleay, 1877:269, pl. 6, fig. 3 (type locality: Katow, New Guinea).

FAO Names: **En** - Orange-spotted grouper; **Fr** - Mérou taches oranges; **Sp** - Mero de pintas naranjas.

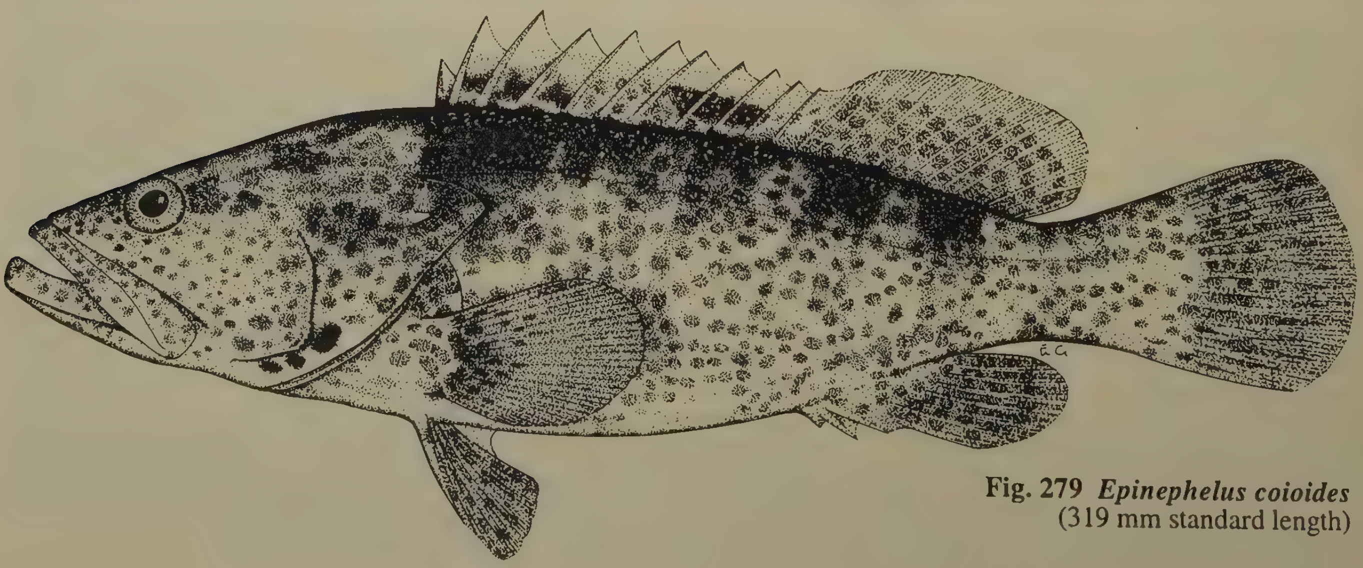


Fig. 279 *Epinephelus coioides*
(319 mm standard length)

Diagnostic Features: Body elongate, the depth contained 2.9 to 3.7 times in standard length (for fish 10 to 78 cm standard length); body width contained 1.4 to 2.0 times in the depth. Head length contained 2.3 to 2.6 times in standard length; snout length contained 1.8 to 1.9 times in upper-jaw length; interorbital flat or slightly convex, interorbital width contained 5.0 to 6.2 times in head length and 2.1 to 3.2 times in upper-jaw length; preopercle subangular, with enlarged serrae at the angle and a broad shallow notch just above the angle; upper edge of operculum straight or somewhat convex; nostrils subequal; maxilla reaches to or slightly past a vertical at rear edge of eye, maxilla width 4.2 to 5.5% of standard length; upper-jaw length 17 to 20% of standard length, midlateral part of lower jaw with 2 or 3 rows of subequal teeth. Gill rakers 8 to 10 on upper limb, 14 to 17 on lower limb, 23 to 26 total; adults with small bony platelets on lateral side of first gill arch. Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, in length 2.9 to 4.0 times in head length, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays, the third spine usually longer than the second; the fin margin rounded; pectoral-fin length contained 1.6 to 2.2 times in head length; pectoral-fin rays 18 to 20; pelvic-fin length contained 1.9 to 2.7 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with minute auxiliary scales; lateral-line scales 58 to 65; lateral-line tubes of anterior scales branched in adults; lateral-scale series 100 to 118. Pyloric caeca numerous (about 50 to 60). **Colour**: Head and body tan dorsally, shading to whitish ventrally; numerous small brownish orange or reddish brown spots on head, body, and median fins; body with 5 faint, irregular, oblique, dark bars which bifurcate ventrally; first dark bar below anterior dorsal-fin spines, last bar on caudal peduncle; 2 dark spots on interopercle and another 1 or 2 at junction of sub- and interopercles. Orange spots turn brown on exposure to air and become fainter (more diffuse) in preservative.

Geographical Distribution: *E. coioides* occurs from the Red Sea south to at least Durban and east to the western Pacific, where it ranges from the Ryukyu Islands to Australia and eastwards to Palau and Fiji. Other localities include the Persian Gulf, India, Réunion, Mauritius, Andaman Islands, Singapore, Hong Kong, Taiwan, and the Philippines (Fig. 280).

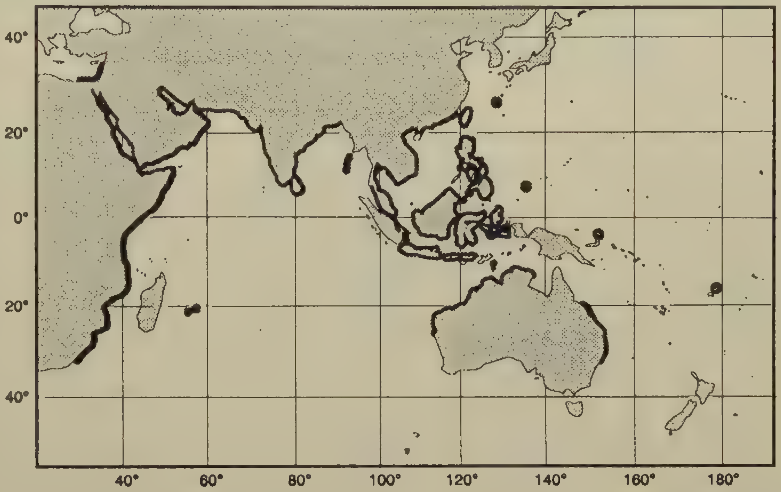


Fig. 280

Ben-Tuvia and Lourie (1969) reported a 420 mm specimen of "*Epinephelus tauvina*" from the Mediterranean coast of Israel. Without further discussion of this fish, Randall and Ben-Tuvia (1983) changed this identification to "*E. malabaricus*" (Note: the account of *E. malabaricus* in this paper is a composite of *E. coioides* and *E. malabaricus*). In the original description of this specimen, Ben-Tuvia and Lourie (1969:246) state "Head and body covered with bright orange spots more or less regularly dispersed ...", which would rule out *E. malabaricus*. In addition to the colour pattern, the meristic and morphometric data given by Ben-Tuvia and Lourie also fit *E. coioides* better than *E. tauvina*. Their specimen, now deposited at the Hebrew University in Jerusalem, was reexamined by P.C. Heemstra and identified as *E. coioides*. Thanks to Dr Adam Ben-Tuvia, we recently examined a 221 mm specimen of *E. coioides* that was collected in Haifa Bay in October 1981.

Habitat and Biology: *E. coioides* is known from continental shores and large islands. It is often found in estuaries, and is also taken offshore to depths of 100 m. Reported stomach contents include fishes, shrimps, crabs and 1 adult cuttlefish (*Sepia* sp.). Age, growth and reproduction were studied by Mathews et al. (1986) in the Persian Gulf, where *E. coioides* (misidentified as "*Epinephelus tauvina*", which does not occur there) has been used in aquaculture trials. The major spawning period is from March to June. Females are mature at 25 to 30 cm total length (2 or 3 years old), and sexual transition occurs as a length of 55 to 75 cm. Fecundity estimates were 850 186 ova for a fish of 35 cm and 2 904 912 ova for one of 62 cm. The eggs are pelagic, and the best survival of larvae was attained at a temperature of 30°C and salinity of 39‰.

Size: Attains at least 95 cm total length.

Interest to Fisheries: *E. coioides* is of considerable economic importance. It is a common and expensive fish in the markets of the Persian Gulf, India, Singapore, Hong Kong, and Taiwan. According to Morgans (1983) *E. coioides* (misidentified as "*E. tauvina*") is the major component of the trap fishery off Kuwait. Because it is esteemed as a food fish and also readily available, it has been the subject of much recent research in aquaculture. Unfortunately, this species is misidentified as "*Epinephelus tauvina*" or "*Epinephelus malabaricus*" in the aquaculture and fisheries literature. *E. coioides* and *E. malabaricus* were not distinguished in most aquaculture work, and both species are cultured in Singapore and Taiwan. It is often kept alive at restaurants in Hong Kong and Taiwan. Caught with hook-and-line, traps, trawls, and with lift nets.

Local Names: HONG KONG: Fah-paan, Estuary grouper; JAPAN: Chairomaruhata; KUWAIT: Hamoor; SINGAPORE: Chi hou.

Literature: Heemstra (1991); Randall and Heemstra (1991). Misidentified as *E. tauvina*: Chan (1968); Tan and Tan (1974); Kuronuma and Abe (1972, 1986); Randall et al. (1978); Tan et al. (1982:22, upper figure); Grant (1982). Misidentified as *E. malabaricus*: Morgans (1966, 1982); Kyushin et al. (1977, 1982); Sainsbury et al. (1985). Identified as *E. suillus*: Heemstra and Randall (1986); Masuda and Allen (1987); Katayama (1988); Allen and Swainston (1988); Doi et al. (1991).

Remarks: As implied by the numerous misidentifications mentioned above, *E. coioides* is often mistaken for *E. malabaricus* and *E. tauvina*. The colour patterns of all 3 species are similar, but the dark spots of *E. malabaricus* are smaller, blackish brown (not reddish brown or brownish orange, as on *E. coioides*), and remain distinct in preservative; *E. malabaricus* also has irregular white spots on the head and body (no white spots on *E. coioides*). *E. tauvina* often has a black blotch (larger than eye) on body at base of last 4 dorsal-fin spines and extending onto lower part of fin, and juveniles have the dark spots on the median fins so close set that the intervening pale spaces appear as a pale reticulum; *E. tauvina* also has a longer jaw (upper jaw length 21 to 24% of standard length, versus 17 to 20% in *E. coioides*), usually more gill rakers (17 to 20 on lower limb, versus 14 to 17 in *E. coioides*), and no small bony platelets on lateral side of first gill arch. A table of comparison for these 3 species is given in the account of *E. malabaricus*.

Epinephelus corallicola (Valenciennes, 1828) Fig. 281; Pl. XE,F SERRAN Epin 68

Serranus corallicola Valenciennes in Cuv. and Val., 1828:336 (type locality: Java).

Synonyms: *Serranus altivelioides* Bleeker, 1849:38 (type locality: Jakarta).

FAO Names: **En** - Coral grouper; **Fr** - Mérou corail; **Sp** - Mero de coral.

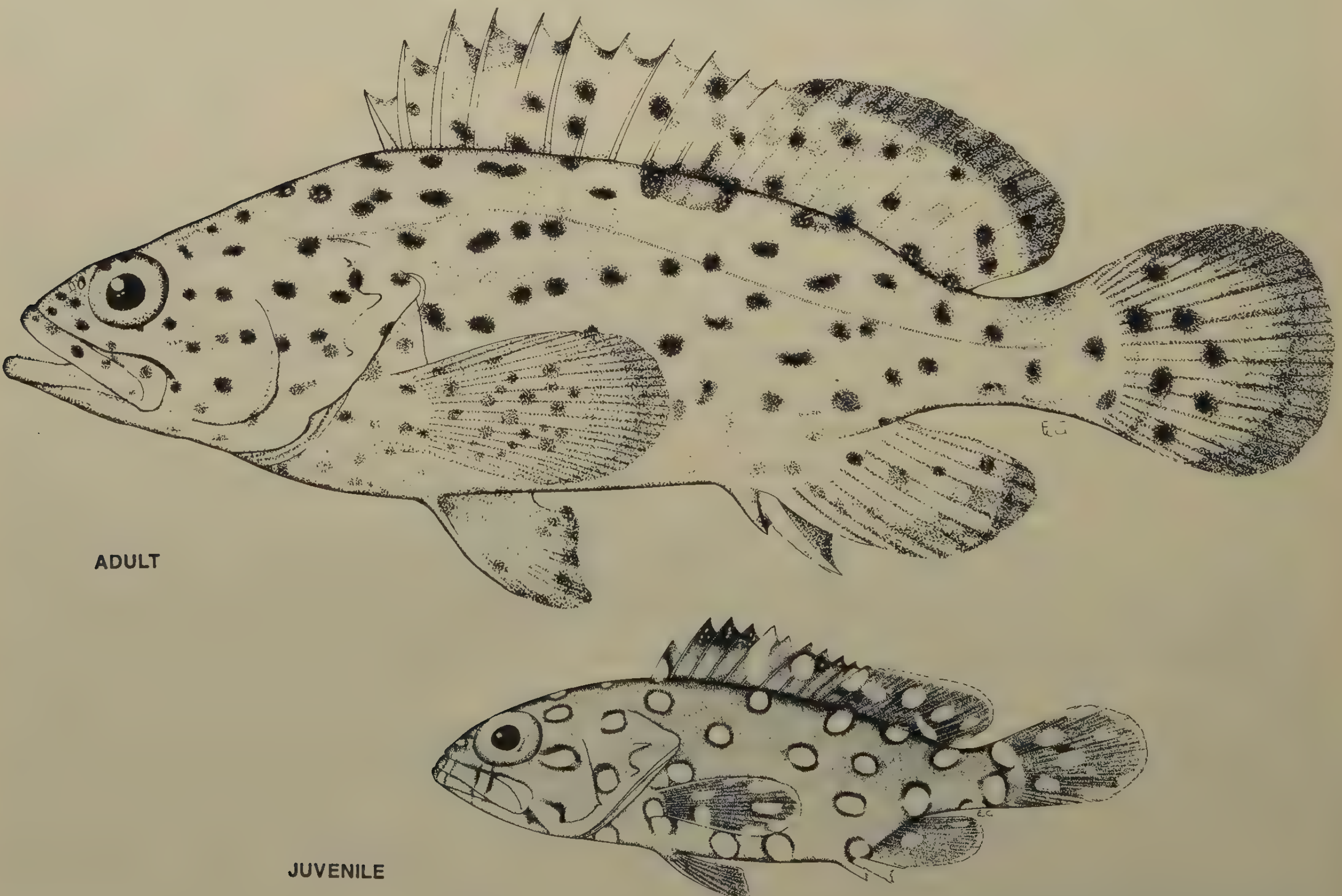


Fig. 281 *Epinephelus corallicola*
(adult 133 mm standard length, juvenile 33 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.7 to 3.2 times in standard length (for fish 9 to 35 cm standard length). Head length contained 2.3 to 2.5 times in standard length; head pointed, the interorbital area flat, and the dorsal head profile almost straight; preopercle rounded, finely serrate, with slight notch; upper edge of operculum convex; posterior nostrils vertically elongated in fish larger than 15 cm standard length, its length 5 or 6 times larger than diameter of anterior nostrils; maxilla reaches about to vertical at rear edge of eye; maxilla naked, mostly covered by upper lip; canines at front of jaws small or absent; midlateral part of lower jaw with 4 to 6 rows of teeth (2 or 3 rows in juveniles). Gill rakers 8 to 10 on upper limb, 14 to 17 on lower limb (with 7 to 10 developed rakers on lower limb); gill rakers shorter than gill filaments; gill raker at angle of first arch subequal to adjacent rakers. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.8 to 3.8 times in head length, the interspinous membranes moderately incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 20; pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic fins not reaching past anus, their length contained 1.9 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid (smooth in large adults), with auxiliary scales; lateral-line scales 53 to 63; lateral-scale series 88 to 109. Pyloric caeca 9 to 13. **Colour**: Head and body brownish to greenish grey; widely spaced small black spots over all of head, body and fins; 3 dark blotches on body at base of dorsal fin, the first (at base of last 2 or 3 dorsal-fin spines) largest and most distinct; dark saddle blotch on caudal peduncle; black streak hidden by upper edge of maxilla when mouth is closed; white line usually present along rear edge of median and pectoral fins. Juveniles 3 to 6 cm standard length with prominent white spots on head, body, and fins, those on head and body with black edges (especially along dorsal and ventral edges of white spots) or 2 contiguous black spots at upper and lower edges of white spots; juveniles 7 to 10 cm with black edges dividing to form 2 to 4 black spots as white spots become fainter; juveniles of 13 or 14 cm with white spots almost completely faded.

Geographical Distribution: Western Pacific from Thailand, Hong Kong, and Taiwan to Australia (Western Australia, Northern Territory, Queensland and New South Wales) and eastward to the Solomon and Mariana Islands, including Indonesia, Singapore, Philippines, Papua New Guinea, and Belau (Fig. 282). The colour photograph of "*Epinephelus corallicola*" reported from Japan by Katayama (1988) is of *E. howlandi*. The record from Christmas Island in the eastern Indian Ocean (Allen and Steene, 1979) is based on McKay's (1974) mistaken placement of *E. spilotoceps* in the synonymy of *E. corallicola*.

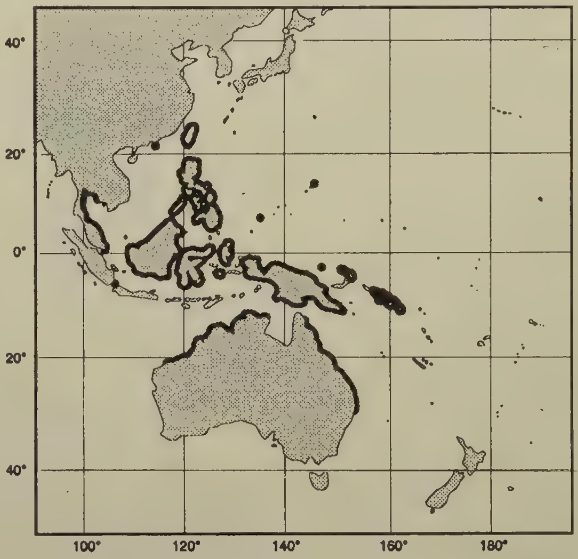


Fig. 282

Habitat and Biology: Shallow silty reefs and estuarine areas. The ovary was well developed in a fish of 30 cm standard length that we examined.

Size: Attains at least 49 cm total length.

Interest to Fisheries: *E. corallicola* is apparently too rare to be of commercial importance.

Local Names: AUSTRALIA: Coral rockcod.

Literature: Randall and Heemstra (1991).

Remarks: Adults are often misidentified as *E. macrospilos*, which differ in having the dark spots on body larger and more closely set, the lower jaw projecting, and the rear nostrils not vertically elongated; also, the juveniles of *E. macrospilos* do not have white spots.

E. corallicola was compared with *E. caeruleopunctatus* in the "Remarks" section of that species account.

E. howlandi differs in lacking dark spots on the belly, chest and underside of head; posterior nostrils not vertically elongated; and the juveniles do not have white spots.

Epinephelus costae (Steindachner, 1878)

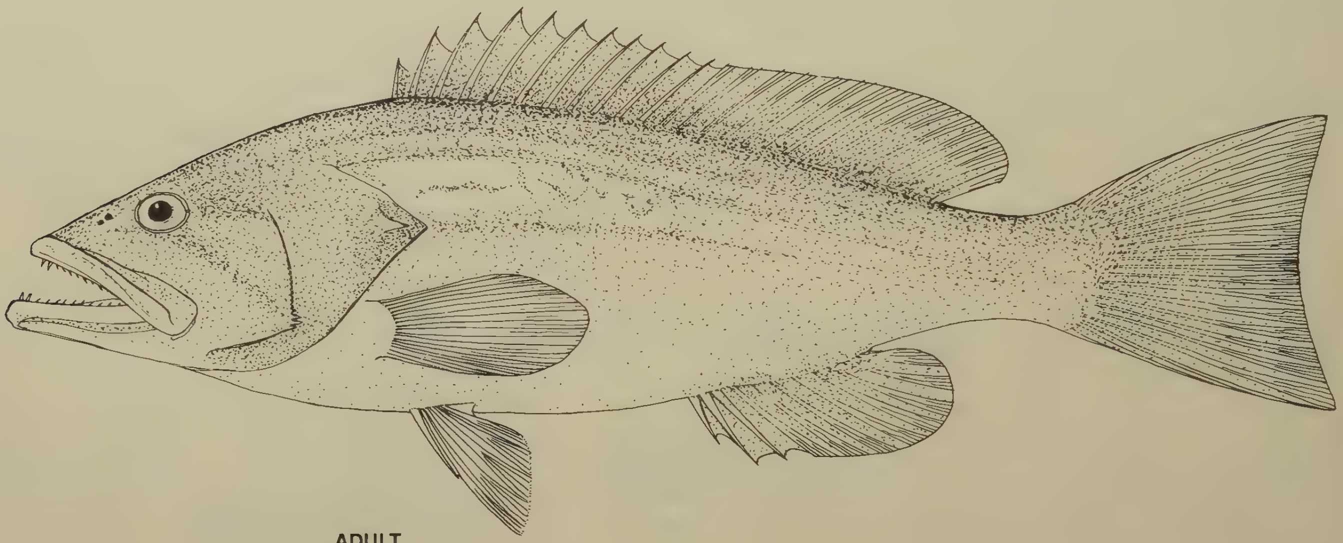
Fig. 283; Pl. XIA,B

SERRAN Epin 2

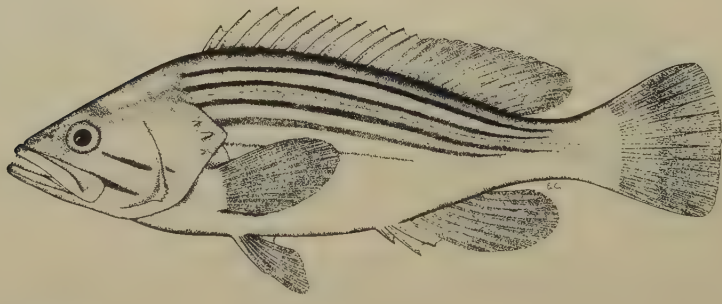
Serranus costae Steindachner, 1878:389 (based on *Plectropoma fasciatus* [non Bloch or Lacepède] Costa, 1836; type locality: southern Italy).

Synonyms: *Plectropoma fasciatus* Costa, 1836:1, pl. 6 (type locality: southern Italy; preoccupied in *Epinephelus* by *Perca fasciata* Forsskål, 1775). *Serranus chrysotaenia* Doderlein, 1882:208, pl. 2, fig. 4 (type locality: Sicily). *Cerna catalonica* Gibert, 1913:38 (type locality: Catalonia, Spain). *Epinephelus zaslavskii* Poll, 1949:191, fig. 12 (type locality: Baie des Eléphants, Angola). *Epinephelus* sp.—A$_1$ Franca, 1957:33; *Epinephelus* sp.—A$_2$ Franca, 1957:34. *Epinephelus alexandrinus* (non Valenciennes): many references (see "Literature" below). *Epinephelus costae*: Heemstra, 1991.

FAO Names: **En** - Goldblotch grouper; **Fr** - Mérou badèche; **Sp** - Falso abadejo.



ADULT



JUVENILE

Fig. 283 ***Epinephelus costae***
(adult, juvenile 170 mm total length)

Diagnostic Features: Body depth less than head length, depth contained 3.0 to 3.4 times in standard length (for fish 10 to 46 cm standard length). Head length contained 2.5 to 2.7 times in standard length; interorbital area convex; preopercle angular, with 2 or 3 greatly enlarged serrae at the angle; in adults larger than 40 cm standard length, the preopercle angle is produced into a rounded lobe, with an indentation immediately above the lobe; middle and lower opercular spines flat but distinct, upper spine not apparent; upper edge of operculum straight or slightly convex; nostrils subequal in specimens less than 30 cm standard length; rear nostril diameter about twice that of anterior nostril in fish of 40 to 50 cm standard length; maxilla usually reaching a vertical at rear edge of eye; ventral edge of maxilla with a low step; no scales on maxilla; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 16 to 18 on lower limb, total 24 to 27. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, subequal to longest dorsal-fin ray, the interspinous membranes distinctly incised; anal fin with III spines and 8 soft rays; pectoral-fin rays 18 or 19; pectoral fins usually longer than pelvic fins, pectoral-fin length contained 1.6 to 2.1 times in head length; caudal fin truncate or slightly convex in juveniles, becoming concave or lunate in adults larger than 40 cm standard length. Lateral-body scales ctenoid; adults with auxiliary scales; lateral-line scales 70 to 73; lateral-scale series 113 to 130. Pyloric caeca 17. **Colour**: Head and body brownish, the fins darker. Juveniles less than 15 cm standard length with 3 to 5 narrow dark stripes (possibly blue in life) paralleling lateral line on dorsal part of body: 2 stripes above and 1 to 3 stripes below lateral line. Two dark lines on head: one from lower edge of eye to ventral rear edge of interopercle, the second from dark maxillary streak to lower edge of preopercle. Adults brown or greyish brown, often with a large, distinct golden yellow blotch (vaguely defined at periphery) on body below spinous dorsal fin. Two specimens from Angola, (Museu Bocage nos. MB 2087 and 2091, 46 and 42 cm standard length; reported by Franca, 1957) are distinctly bicoloured, the body dark brown dorsally and abruptly paler ventrally, the two parts separated by a wavy boundary. Both fish are males, with flaccid testes containing a large empty lumen; if the condition of the testes is indicative of recent spawning, the bicoloured pattern may be the spawning coloration of this species.

Geographical Distribution: *E. costae* occurs in the eastern Atlantic and Mediterranean. We have examined specimens from Greece (Corfu Island), the Cape Verde Islands, and Angola. Reliable literature records document its occurrence on the Mediterranean coasts of Italy, France, Spain, Egypt, Tunisia, also along the south coast of Portugal, and along the west coast of Africa from Morocco to southern Angola (Fig. 284). Alberto Brito informed us that *E. costae* is known in the Canary Islands from only 10 records, and these are mostly based on juvenile specimens. Records of "*Epinephelus alexandrinus*" from Madeira (see Remarks, below) are apparently based on misidentifications of *Mycteroperca fusca*.

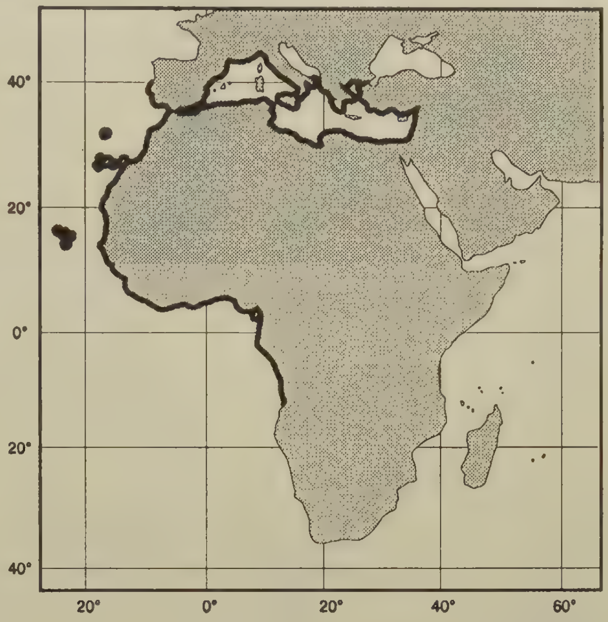


Fig. 284

Habitat and Biology: According to Poll (1954) *E. costae* (identified as *E. zaslavskii*) is found on a variety of bottom types (sand, mud, or rock) in depths of 20 to 80 m. Maurin (1968) reported *Epinephelus alexandrinus* (probably *E. costae*) as rather common on clumps of coral off Cape Blanc on the north coast of Mauritania. Age and growth of Egyptian specimens (identified as "*Epinephelus alexandrinus*") were studied by Wadie et al. (1981). Bouain (1986) reported a maximum age of 11 years for "*Epinephelus alexandrinus*" of 50 cm standard length from Tunisia, and a growth coefficient (K) = 0.042 derived from the Von Bertalanffy growth equation for this population. Bouain and Siau (1983) estimated total potential fecundity for an "*Epinephelus alexandrinus*" of 46.5 cm standard length to be 879 038 eggs. Larvae described as "*Epinephelus alexandrinus*" by Bertolini (1933) and Sparta (1935) are actually *Mycteroperca rubra*.

Size: Maximum total length probably about 80 cm. According to Tortonese (1986), this species (identified as "*Epinephelus alexandrinus*") attains 140 cm standard length.

Interest to Fisheries: This species is of some importance to the fisheries of the Mediterranean and west coast of Africa.

Local Names: ALGERIA: Abadèch; EGYPT: Wakar; FRANCE: Badèche; GREECE: Stira; ITALY: Cernia dorata; PORTUGAL: Garoupa amarela; SENEGAL: Doy; SPAIN: Jabali; TUNISIA: Mennani; TURKEY: Tashanisi; YUGOSLAVIA: Kirnja ligaca.

Literature: Most of the recent (since 1895) literature has used the name *Epinephelus alexandrinus* for this species: Cadenat (1935, 1951); Torchio (1963); Bini (1968); Tortonese (1973, 1975, 1986); Bianchi (1986); Bauchot (1987); Manzoni (1987); Bellemans et al. (1988).

Remarks: Following Boulenger's (1895) authoritative work on serranid fishes, this species has generally been referred to as *Epinephelus alexandrinus* (Valenciennes, 1828). Unfortunately, Valenciennes' holotype of *Serranus alexandrinus* (MNHN 7325) is a specimen of the well-known *Epinephelus fasciatus* of the Red Sea and Indo-Pacific region. This holotype differs significantly from the species here recognized as *E. costae* in having fewer scales (lateral-line 54, versus 70 to 73; lateral-scale series about 100, versus 113 to 130), deeper body (depth 2.8 times in standard length, versus 3.0 to 3.4 times in standard length), 3 or 4 rows of teeth at midside of lower jaw (versus 2 rows), fewer gill rakers (7 on upper limb and 15 on lower limb, 22 in total, versus 8 to 10 on upper limb, 16 to 18 on lower limb, 24-27 in total); and a rounded caudal fin (the shape of the caudal fin of the holotype cannot now be determined, as it is damaged; but in his description of *Serranus goreensis*, Valenciennes (1830) mentioned that the caudal fin of *E. alexandrinus* is rounded). In his original description, Valenciennes (1828) wrote "Sa couleur paraît avoir été brune, sans taches ni marbrures, sur tout le corps et sur les nageoires." *E. fasciatus* has distinctive black triangles at the margin of the interspinous dorsal-fin membranes, and these are clearly seen on the holotype of *S. alexandrinus* if the fin is erected. This feature was overlooked by Valenciennes and subsequent workers. The holotype also still shows the dark pigment on the edge of the orbit that is typical of ***E. fasciatus***. Although Valenciennes gave the place of origin of his holotype as "rapportée de l'Égypte par M. Geoffroy," his choice of name for his new species (***Serranus alexandrinus***) implied that it was a Mediterranean species; and this accounts for the misapplication of this species name by subsequent authors.

Bauchot et al. (1960) discussed the synonymy of "***Epinephelus alexandrinus***" in which they included ***Epinephelus zaslavskii*** Poll, 1949, but they did not give any data on the holotype of ***Serranus alexandrinus***.

E. costae is similar to ***E. goreensis*** in meristic and most morphometric features, but these two species can be distinguished by their colour patterns. Juveniles of ***E. costae*** have 3 to 5 narrow dark stripes paralleling the lateral line (no dark stripes in ***E. goreensis***), and live (or freshly dead) adults of ***E. costae*** often have a large golden yellow blotch on the body below the spinous dorsal fin. ***E. costae*** has never been reported with the subvertical dark bars or "saddles" on the dorsal part of the body that are characteristic for ***E. goreensis***. Séret (1981) published an excellent figure of ***E. costae*** (identified as ***E. goreensis***). Reports of "***Epinephelus alexandrinus***" from Madeira and the Azores (Saldanha, 1979; Waschkewitz and Wirtz, 1990) are apparently misidentifications (based on underwater visual identifications or photographs of live fish) of ***Mycteroperca fusca***, which is superficially similar to ***E. costae*** (both species are relatively elongate, somewhat compressed groupers with concave or lunate caudal fins in adults and a protruding lower jaw). The Spanish common name "falso abadejo" for ***E. costae*** alludes to its similarity to ***M. fusca***, the true "abadejo." ***M. fusca*** is common at Madeira, and is well known to the fishermen as "abadejo." According to G.E. Maul, ichthyologist at the Funchal Municipal Museum for the past 50 years, ***M. fusca*** and the mero (***E. marginatus***) are the only two species of groupers that occur in Madeiran waters. Examination of Madeiran specimens in the Funchal Museum and at the British Museum (Natural History) also confirms Mr Maul's statement.

Epinephelus cyanopodus (Richardson, 1846) Fig. 285; Pl. XIC,D SERRAN Epin 69

Serranus cyanopodus Richardson, 1846:233 (type locality: Guangzhou, China).

Synonyms: ***Serranus Hoedtii*** Bleeker, 1855c:406 (type locality: Ambon). ***Serranus punctatissimus*** Günther, 1859:144 (type locality: China). ***Homalogrystes luctuosus*** De Vis, 1883b:369 (type locality: Brisbane, Australia). ***Epinephelus suitonis*** Tanaka, 1915:566 (type locality: Saiki, Oita Prefecture, Japan). ***Epinephelus kohleri*** Schultz in Schultz et al., 1953:329, 336, fig. 51 (type locality: Rongerik Atoll, Marshall Islands).

FAO Names: **En** - Speckled blue grouper; **Fr** - Mérou bleu; **Sp** - Mero azul.

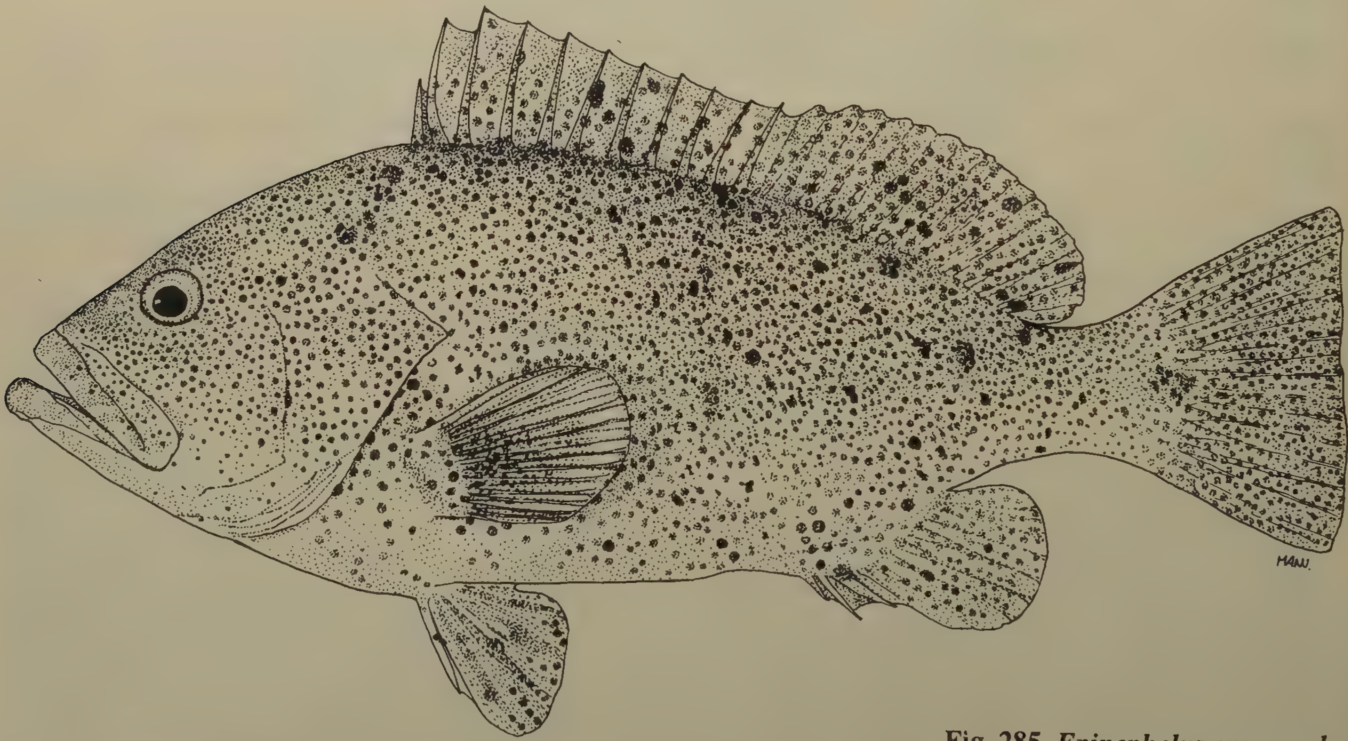


Fig. 285 *Epinephelus cyanopodus* (319 mm standard length)

Diagnostic Features: Body deep and compressed, the depth subequal to head length, contained 2.4 to 2.7 times in standard length (for fish 11 to 43 cm standard length); body width contained 1.9 to 2.8 times in the depth. Dorsal head profile steep, the interorbital area distinctly convex; preopercle subangular, finely serrate, serrae at rounded corner slightly enlarged; opercular spines inconspicuous; upper edge of operculum straight; posterior nostrils of adults 2 or 3 times larger than anteriors; maxilla reaches about to vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 9 or 10 on upper limb, 15 to 17 on lower limb, 24 to 27 total. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.2 to 2.8 times in head length, the interspinous membranes not or only slightly incised; anal fin with III spines and 8 rays; pectoral fins thin (not fleshy), with 18 to 20 rays; pectoral fins subequal to pelvic fins, their length contained 1.7 to 2.0 times in head length; caudal fin truncate or slightly emarginate. Lateral-body scales distinctly ctenoid, with auxiliary scales; lateral-line scales 63 to 75; lateral-scale series 128 to 147. Pyloric caeca very numerous. **Colour**: Adults usually pale bluish grey, covered with black dots and a few scattered, irregular black spots; broad black submarginal band on caudal fin of some large juveniles; pelvic fins usually black tipped. Juveniles with yellow fins; body of small juveniles (to 12 cm standard length) mainly yellow, the head and front part of body with a wash of bluish grey and faint dark dots.

Geographical Distribution: Western Pacific, from southern Japan to southern Queensland and east to Fiji and the islands of Micronesia; *E. cyanopodus* is also known from Taiwan, Hong Kong, Viet Nam, Gulf of Thailand, Indonesia, Philippines, Papua New Guinea, New Caledonia, and Lord Howe Island (Fig. 286). The only record from the Indian Ocean (a specimen in the Vienna Museum, NMW 40520, 293 mm standard length, from Western Australia) is dubious; the species was not reported from Western Australia by Allen and Swainston (1988), and there are no specimens from there in the Western Australian Museum.

Habitat and Biology: *E. cyanopodus* is usually found on isolated coral heads in lagoons or bays, but it is also caught at depths to 150 m on the outer reef area. Myers (1989) wrote that it usually swims out in the open, several metres above the bottom, and Grant (1975) noted that it is readily caught by anglers at night. Reported stomach contents are fishes and calappid crabs.

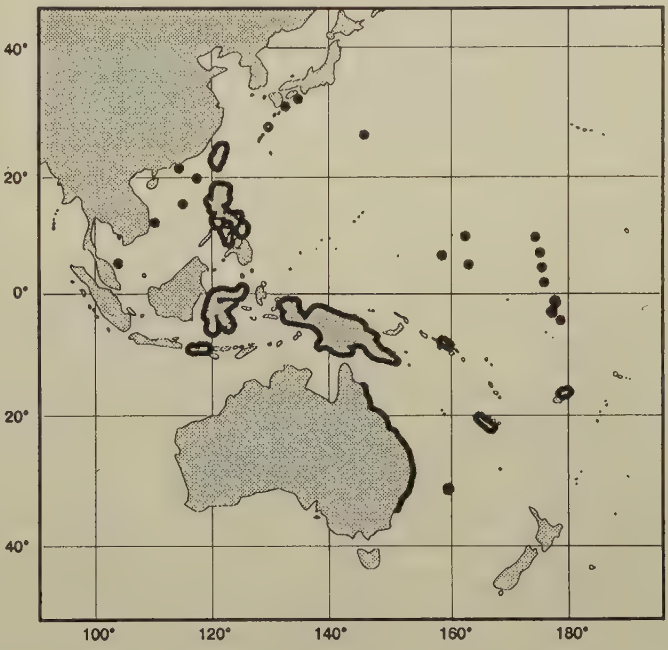


Fig. 286

Size: Attains 120 cm total length.

Interest to Fisheries: According to Chan (1968), *E. cyanopodus* was abundant at Macclesfield Bank and Pratas Reef in the South China Sea. It is caught with trawls, handlines, and longlines.

Local Names: AUSTRALIA: Purple rockcod, Blue Maori; HONG KONG: Naam-dim-paan; JAPAN: Tsuchihozeri; NEW CALEDONIA: Loche bleue, Loche morue; PAPUA NEW GUINEA: Taguma; PHILIPPINES: Kobe (Visayan).

Literature: Randall and Whitehead (1985); Randall and Heemstra (1991).

Remarks: *E. cyanopodus* is closely related to *E. flavocaeruleus* and *E. multinotatus* of the Indian Ocean. These two allopatric species differ from *E. cyanopodus* only in colour pattern.

SERRAN Epin 70

Epinephelus daemelii (Günther, 1876)

Fig. 287; Pl. XIE

Serranus Dämelii Günther, 1876:391 (type locality: Sydney, Australia).

Synonyms: *Epinephelus forsythi* Whitley, 1937b:222, pl. 13, fig. 4 (type locality: Lord Howe Island).

FAO Names: **En** - Saddletail grouper; **Fr** - Mérou troussequin; **Sp** - Mero montado.

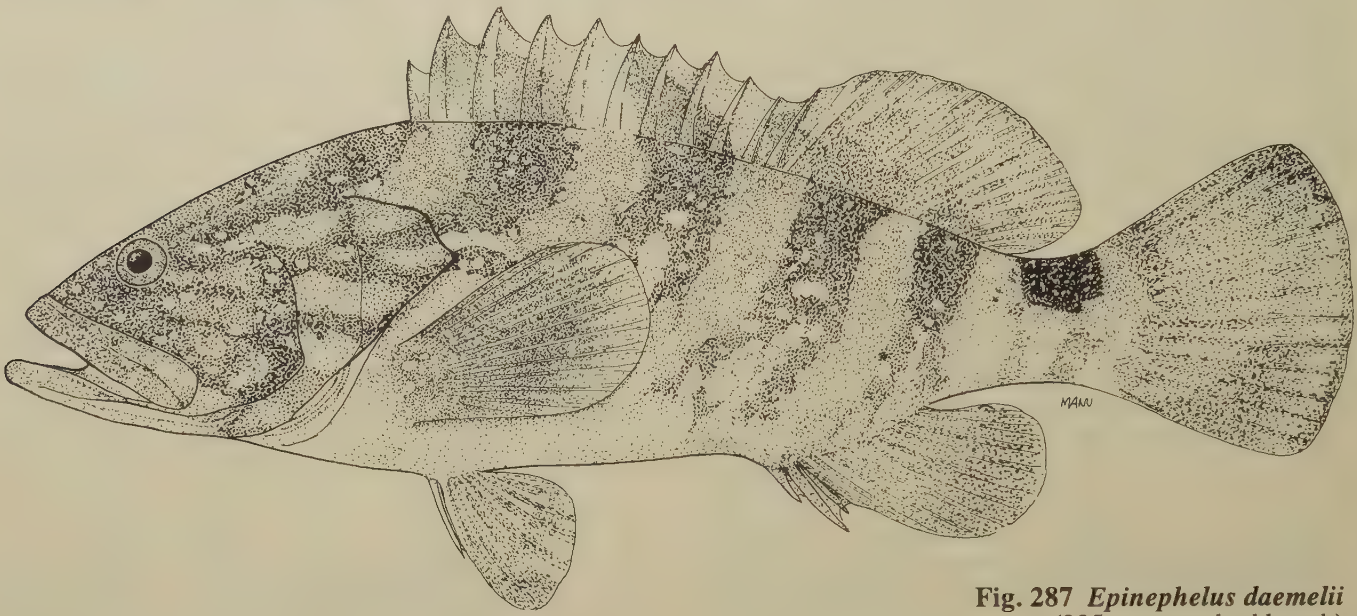


Fig. 287 *Epinephelus daemelii* (235 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.3 times in standard length (for fish 11 to 45 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat to slightly convex; dorsal head profile almost straight; preopercle rounded, finely serrate; opercular spines inconspicuous; upper edge of operculum distinctly convex; posterior nostrils of adults enlarged, 2 to 4 times larger than anterior nostrils; maxilla reaches past vertical at rear edge of eye; canines at front of jaws well developed, particularly the inner depressible teeth at symphysis of upper jaw; midlateral part of lower jaw with 2 rows of large teeth. Gill rakers 9 to 12 on upper limb, 15 to 19 on lower limb, 25 to 28 total; longest gill raker shorter than longest gill filaments. Dorsal fin with XI spines and 14 rays, the third to last spines subequal and shorter than longest dorsal-fin rays and the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral fins large and fleshy, with 17 to 19 rays; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic fins not reaching anus, their length contained 2.1 to 2.5 times in head length; caudal fin rounded. Lateral-body scales smooth (except for area covered by pectoral fins), with auxiliary scales; lateral-line scales 63 to 71; lateral-scale series 111 to 126. **Colour**: Head and body greyish brown or dark greenish brown with small irregular pale yellow or whitish spots; black saddle blotch on peduncle. Juveniles and subadults with 4 irregular, oblique, dark brown bars on body and a dark band from nape to eye; median and pelvic fins with narrow white margins on some fish. Large adults often uniformly dark brown or black, the underside of head pale and a few pale spots on cheeks.

Geographical Distribution: Temperate and subtropical waters of the southwestern Pacific: Australia, Lord Howe Island, Norfolk Island, Kermadec Islands, and New Zealand (North Island and Poor Knights Islands). The Australian range extends from southern Queensland to Kangaroo Island off South Australia; reported from the Bass Strait, but not known from the coast of Tasmania (Fig. 288).

Habitat and Biology: Rocky reefs from near shore to depths of at least 50 m. *E. daemelii* is an aggressive territorial species that may occupy a particular cave for life. According to Francis (1988), sexual transition occurs at a length of 100 to 110 cm. Juveniles feed on crabs and fishes.

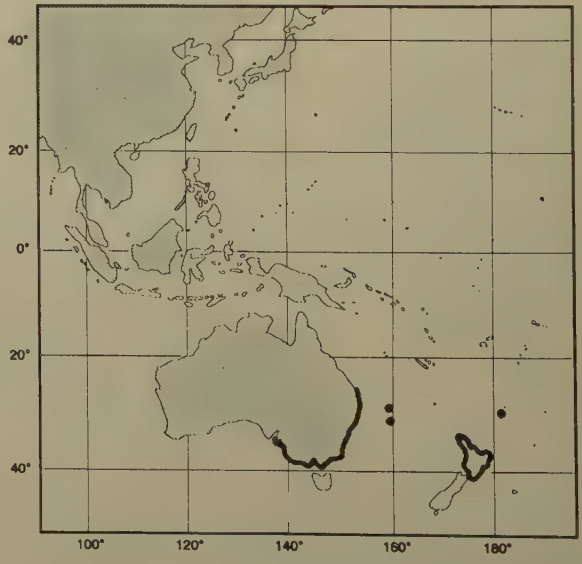


Fig. 288

Size: Attains at least 122 cm total length and a weight of 64 kg.

Interest to Fisheries: *E. daemelii* is an esteemed food fish, and it is avidly sought by anglers and spearfishermen.

Local Names: AUSTRALIA: Black rockcod, Saddled rockcod; NEW ZEALAND: Spotted black grouper.

Literature: Randall and Heemstra (1991); Paxton et al. (1989).

Epinephelus darwinensis Randall and Heemstra, 1991

Fig. 289; Pl. XIF

SERRAN Epin 71

Epinephelus darwinensis Randall and Heemstra, 1991:133, pl. 11B; fig. 66 (type locality: Timor Sea, north of Bathurst Island, Australia).

Synonyms: None.

FAO Names: **En** - Darwin grouper; **Fr** - Mérou Darwin; **Sp** - Mero de Darwin.

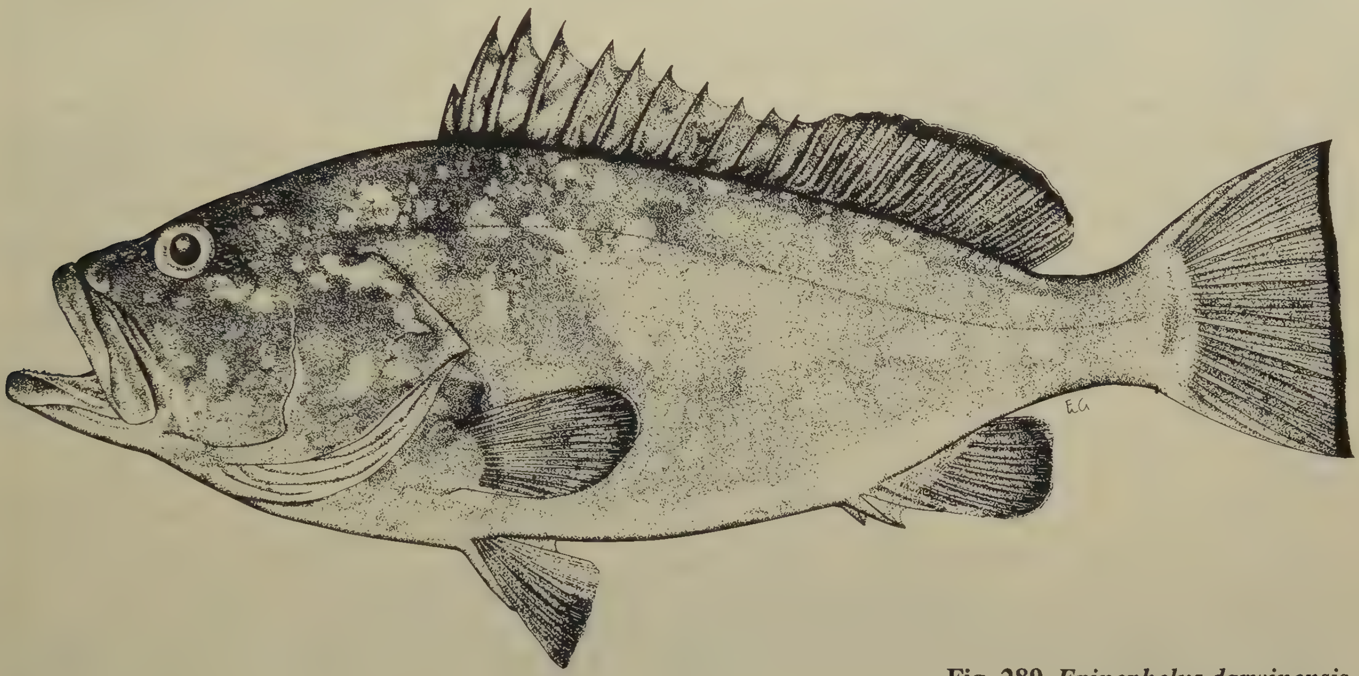


Fig. 289 ***Epinephelus darwinensis***
(532 mm standard length)

Diagnostic Features: Body depth contained 2.8 times in standard length (holotype 535 mm standard length). Head length contained 2.6 times in standard length); interorbital area convex; dorsal head profile almost straight; preopercle angle rounded, with a shallow indentation above angle and no enlarged serrae; upper edge of operculum straight; maxilla reaching almost to vertical at rear edge of eye; posterior nostrils 2.5 times larger than anterior nostrils; maxilla rounded posteriorly, with a prominent angle (hidden by lower lip) on lower edge; anterior canines in jaws small; midlateral part of lower jaw with 3 or 4 rows of small teeth. Gill rakers 9 on upper limb, 16 on lower limb; longest gill raker (first on lower limb next to raker at angle) shorter than longest gill filaments; small bony platelets present on side of first gill arch. Dorsal fin with XI spines and 16 rays, the third spine longest, twice length of last spine, distinctly longer than longest rays and contained 2.9 times in head length; interspinous dorsal-fin membranes moderately incised; anal fin with III spines and 8 rays; pectoral-fin rays 18; pectoral fins equal to pelvic fins, their length contained 2.35 times in head length; caudal fin truncate. Lateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 71; lateral-scale series 147. **Colour**: Yellowish brown, shading to yellowish ventrally; small faint irregular pale spots scattered over head and body; dorsal and caudal fins yellowish brown, the caudal with a black posterior margin; soft dorsal and anal fins with traces of a white line along distal margin; pectoral and pelvic fins blackish distally.

Geographical Distribution: Known from a single specimen caught off the north coast of Australia and landed at Darwin (Fig. 290).

Habitat and Biology: Depth of capture 107 m.

Size: 53,5 cm standard length, 62 cm total length.

Interest to Fisheries: Unknown.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: The affinities of this species are unclear.

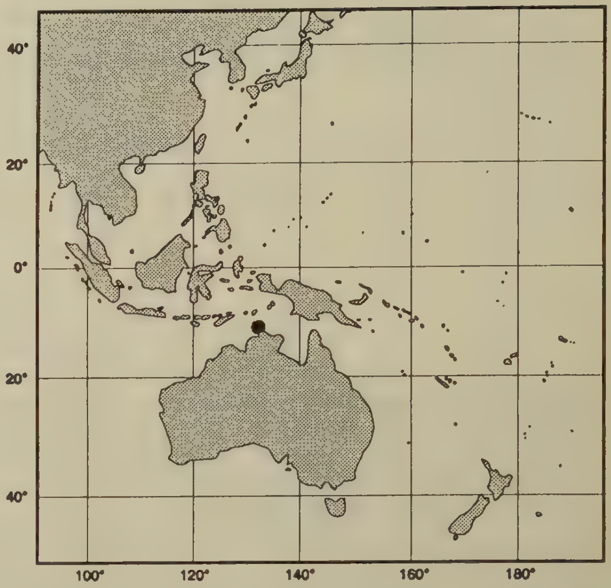


Fig. 290

Epinephelus diacanthus (Valenciennes, 1828) Fig. 291; Pl. XIIA **SERRAN Epin 30**

Serranus diacanthus Valenciennes in Cuv. and Val., 1828:319 (type locality: Malabar coast, Kerala, India).

Synonyms: ***Serranus sexfasciatus*** (non Valenciennes): Day, 1865:2 (Cochin, India). ***Epinephelus Dayi*** Bleeker, 1874:105 (based on ***Serranus sexfasciatus***: Day, 1865).

FAO Names: **En** - Spinycheek grouper (formerly: Thornycheek grouper; **Fr** - Mérou épineux; **Sp** - Mero espinudo.

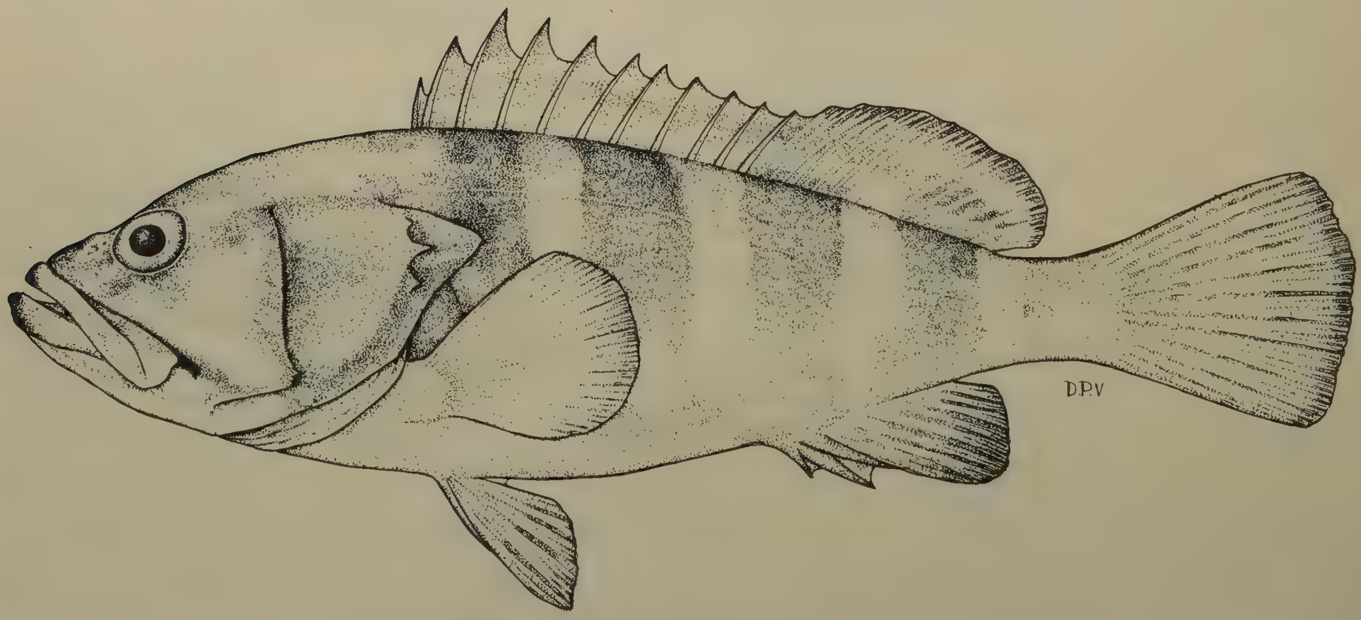


Fig. 291 ***Epinephelus diacanthus***
(327 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.5 times in standard length (for fish 10 to 34 cm standard length). Head large, its length contained 2.2 to 2.4 times in standard length; interorbital region flat or slightly convex, the dorsal profile convex; preopercle with 1 to 5 prominent spines at the angle; upper edge of operculum straight or slightly convex; nostrils subequal; anterior nostrils tubular, the margin usually with a large, bilobed flap of skin; maxilla reaches to or almost to vertical at rear edge of eye, the lower edge smoothly curved; midlateral part of lower jaw with 2 rows of short, subequal teeth. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb; numerous bony plates on sides of gill arches. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.8 to 3.6 times in head length and longer than longest ray, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral fins with 17 to 20 rays; pectoral-fin length contained 1.7 to 2.1 times in head length; pelvic fins end well short of anus, their length contained 2.0 to 2.6 times in head length; caudal fin usually rounded or convex; caudal-peduncle depth contained 3.7 to 4.7 times in head length. Lateral-body scales ctenoid, with auxiliary scales in adults; lateral-line scales 52 to 60; lateral-scale series 103 to 121. Pyloric caeca 7 or 8. **Colour**: Body pale greyish brown, usually with 5 dark vertical bars broader than interspaces, 4 below dorsal fin and fifth (faintest) on peduncle; ventral part of head and body often pink or reddish; dark maxillary streak continues faintly to lower edge of preopercle; fins dusky grey without spots.

Geographical Distribution: *E. diacanthus* occurs on the continental shelf of the northern Indian Ocean from the Gulf of Aden to Sri Lanka and Madras, India. Not known from the Persian Gulf or the Red Sea (Fig. 292).

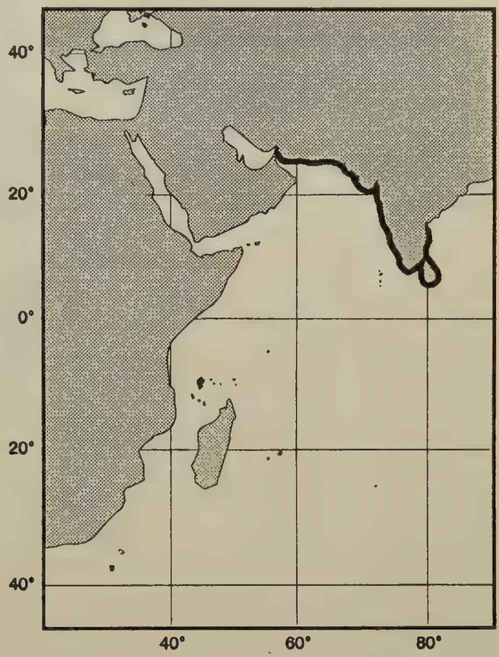


Fig. 292

Habitat and Biology: *E. diacanthus* occurs on mud or muddy sand bottom in depths of 10 to 120 m.

Size: According to Boulenger (1895), this species attains 52 cm total length.

Interest to Fisheries: According to Talwar and Kacker (1984), *E. diacanthus* is an important component of the grouper fishery off the Kerala coast in depths of 63 to 100 m. Common in catches off Bombay. Caught with trawls, traps, gill nets, and hook-and-line.

Local Names: INDIA: Hekaru, Gobra (Marathi).

Literature: Randall and Heemstra (1991).

Remarks: Records of *E. diacanthus* from the western Pacific are based on misidentifications of *E. stictus*: Japan (Katayama, 1988), Hong Kong (Chan, 1968), Viet Nam (Fourmanoir, 1965); or *E. fasciatomaculos* : Burgess et al., 1988), Taiwan (Shen, 1984). Records from South Africa (Fowler, 1925, 1934; Smith, 1949, 1961) are misidentifications of *E. rivulatus*. *E. diacanthus* is similar to the allopatric species *E. sexfasciatus* and *E. stictus*, which also have 5 dark bars on the body and distinctly enlarged serrae at the angle of the preopercle. *E. sexfasciatus*, the western Pacific sister species of *E. diacanthus*, differs in having black spots on the median fins, fewer scales (lateral-line 46 to 51, lateral-scale series 82 to 96), a smaller head (length contained 2.4 to 2.6 times in standard length) and deeper caudal peduncle (depth contained 2.6 to 3.4 times in head length). *E. stictus* has numerous black dots on the head and front part of the body, fewer scales (lateral-line 48 to 51, lateral-scale series 84 to 96) and no auxiliary scales.

Epinephelus drummondhayi Goode and Bean, 1879

Fig. 293; Pl. XIIB,C

SERRAN Epin 14

Epinephelus Drummond-Hayi Goode and Bean, 1879:173 (type locality: southern Florida and Pensacola, Florida).

Synonyms: None.

FAO Names: **En** - Speckled hind; **Fr** - Mérou grivelé; **Sp** - Mero pintaroja.

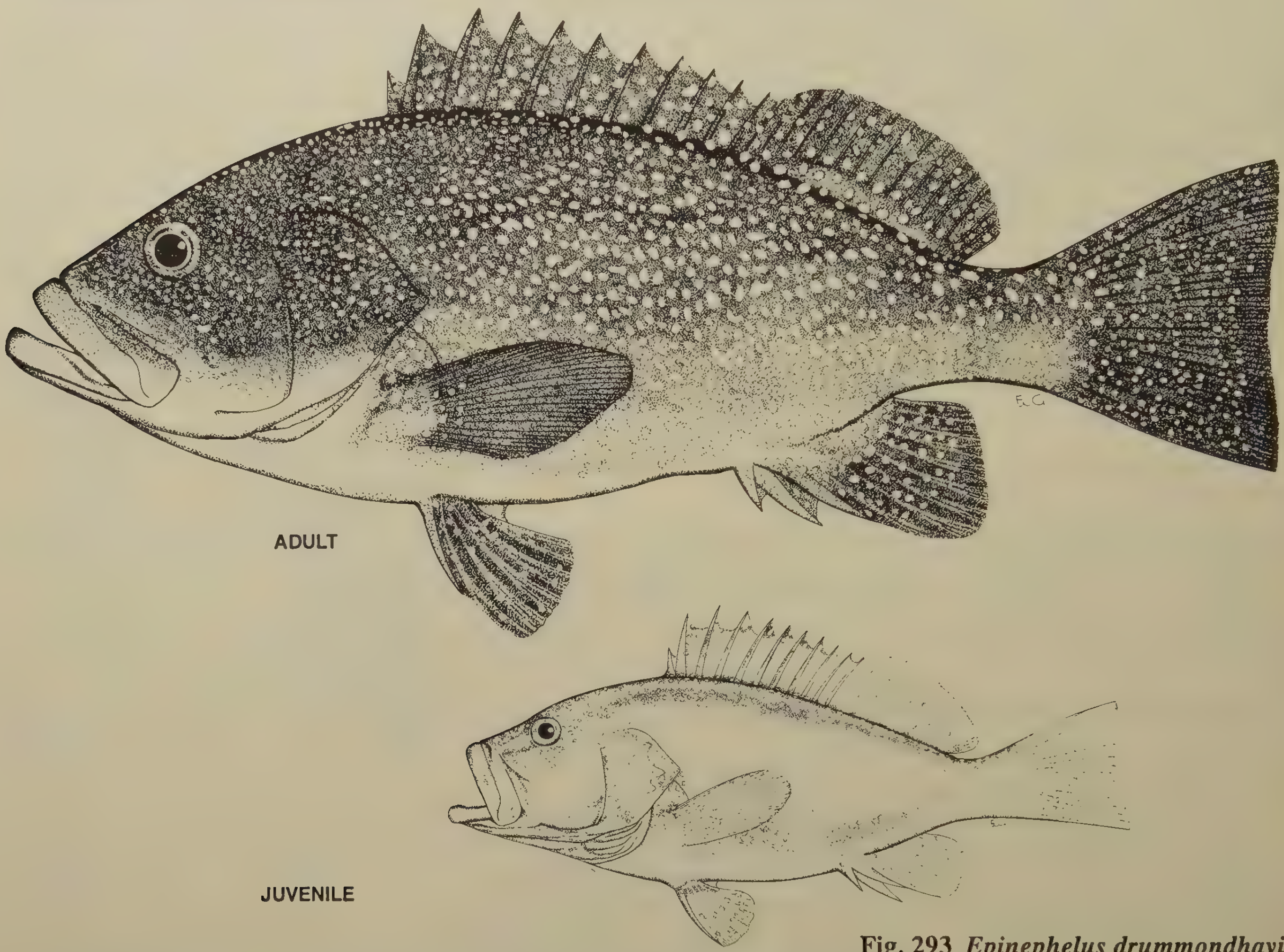


Fig. 293 ***Epinephelus drummondhayi***
(adult 400 mm standard length, juvenile about 150 mm total length)

Diagnostic Features: Body depth subequal to head length, depth contained 2.4 to 2.6 times in standard length (for fish 20 to 43 cm standard length). Interorbital area distinctly convex; preopercle evenly serrate, without salient angle; interopercle and subopercle finely serrate, but the serrae covered by skin; nostrils subequal. Gill rakers 9 or 10 on upper limb and 17 or 18 on lower limb, total 26 to 28. Dorsal fin with XI spines and 15 or 16 rays, the membrane incised between the anterior spines; anal fin with III spines and 9 rays; pectoral-fin rays 18; caudal fin truncate or slightly emarginate, the corners acute. Scales strongly ctenoid, with numerous auxiliary scales; lateral-line scales 72 to 76, about 125 lateral-scale series. **Colour**: Adults (greater than 30 cm standard length) dark reddish brown, densely covered with small pearly white spots; pectoral fins yellowish distally. Juveniles (15 to 27 cm standard length) are bright yellow covered with small bluish white spots.

Geographical Distribution: Bermuda and the coast of the USA from North Carolina to the Florida Keys and in the northern and eastern Gulf of Mexico (Fig. 294). Reports of speckled hind from Cuba and the Bahamas are unsubstantiated.

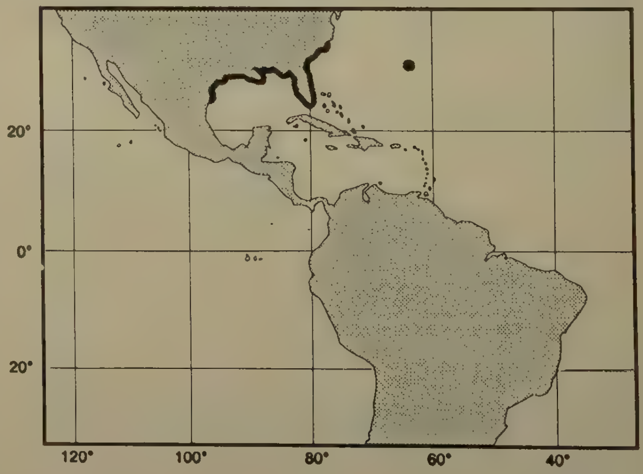


Fig. 294

Habitat and Biology: Adults inhabit offshore rocky bottoms in depths of 25 to 183 m but are most common between 60 and 120 m. Females are mature at 4 or 5 years of age and a total length of 45 to 60 cm. Spawning occurs from July to September, and a large female may produce up to 2 000 000 eggs at one spawning.

Data on age and growth were reported by Matheson and Huntsman (1984): Back calculated total lengths for fish aged 1 to 15 years are respectively 186, 317, 408, 475, 528, 572, 613, 645, 678, 709, 739, 774, 804, 839, and 861 mm; the maximum age attained is at least 25 years, and the largest specimen measured was 110 cm. The weight/length relationship is $W = 1.1 \times 10^{-8} L^{3.073}$ for W in kilogrammes and L (total length) in millimetres. The von Bertalanffy growth equation is $L_t = 967(1-e^{-0.13(t+1.01)})$. Adults feed on a variety of fishes and invertebrates, including shrimps, crabs, scyllarid lobsters, squid, and octopus.

Size: Maximum total length about 110 cm; maximum weight 30 kg. The IGFA all-tackle record (as of 1990) is 19.23 kg.

Interest to Fisheries: ***Epinephelus drummondhayi*** is an important species in the recreational and commercial fisheries of the southeastern USA. Mainly caught with hook-and-line, but some might also be taken in traps, trawls, and on bottom-set longlines.

Local Names: USA: Kitty Mitchell, Calico grouper.

Literature: Matheson and Huntsman (1984); Ross (1988); Smith (1971); Bullock and Smith (1991).

Epinephelus epistictus (Temminck and Schlegel, 1842)

Fig. 295; Pl. XIID,E SERRAN Epin 31

Serranus epistictus Temminck and Schlegel, 1842:8 (type locality: Japan).

Synonyms: ***Serranus praeopercularis*** Boulenger, 1887:654 (type locality: Muscat, Oman). ***Epinephelus stigmogrammacus*** Cheng and Yang, 1983:506, figs 1 to 3 (type locality: South China Sea). ***Epinephelus*** sp. Heemstra and Randall, 1986. Sometimes misidentified as ***E. magniscuttis*** or ***E. heniochus***.

FAO Names: **En** - Dotted grouper (formerly: Broken-line grouper); **Fr** - Mérou pâle; **Sp** - Mero pálido

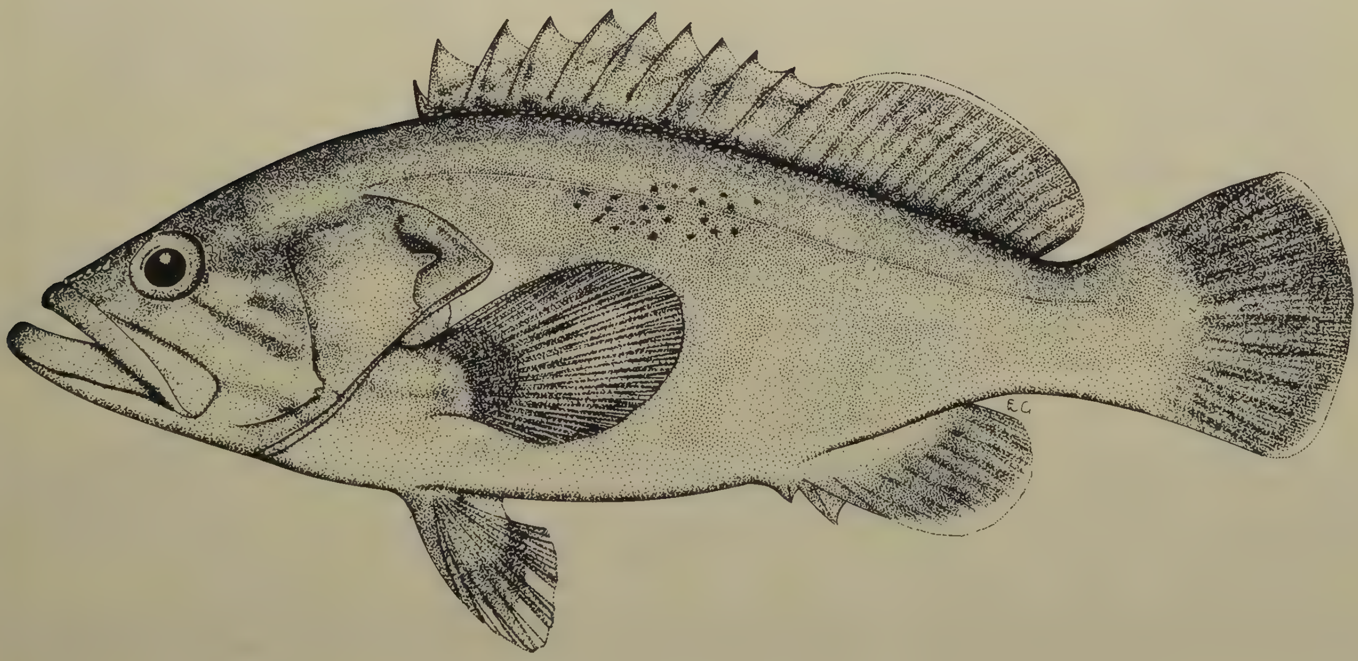


Fig. 295 ***Epinephelus epistictus***
(440 mm standard length)

Diagnostic Features: Body depth contained 3.0 to 3.3 times in standard length (for fish 12 to 50 cm standard length). Head length contained 2.2 to 2.5 times in standard length; interorbital area and dorsal head profile slightly convex; preopercle angle produced, with 3 to 5 distinctly enlarged serrae; upper edge of operculum straight or slightly convex; anterior and posterior nostrils of adults subequal or rear nostrils about twice as large as anterior nostrils; maxilla reaches to, almost to, or slightly past vertical at rear edge of eye; adults with a step or abrupt bend on ventral edge of maxilla; midlateral part of lower jaw with 2 rows of teeth, the inner ones slightly larger. Gill rakers 7 to 10 on upper limb, 15 to 19 on lower limb; length of longest gill raker subequal to longest gill filaments. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, usually shorter than longest ray, the interspinous membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic fins end well short of anus, their length contained 2.0 to 2.6 times in head length; caudal fin slightly to moderately rounded. Lateral-body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 57 to 70; lateral-scale series 105 to 127. Pyloric caeca 7 to 10. **Colour**: Head and body pale brownish or greenish grey, with conspicuous, small, brownish black spots on dorsolateral part of body, rear part of head, and on median fins; some specimens with faint dark band from eye to end of operculum, another from eye to notch of preopercle, and third a continuation of maxillary streak; pectoral-fin rays brownish, the membranes clear. Juveniles with dark spots on head and body arranged in 3 longitudinal rows. Indian Ocean specimens are usually coloured as follows: Head, body, and fins brown or olive; faint brownish black dots usually visible on dorsolateral part of body and sometimes on postorbital part of head; dark brown maxillary streak present; some specimens with a row of faint dark spots along middle of soft dorsal fin, and a faint pale submarginal band or row of faint pale spots immediately distal to these dark spots; adults from South Africa dark brown, with pale or white edge on soft dorsal, anal, and "corners" of caudal fin. Juveniles with faint dark brown stripe from eye to end of operculum, another darker stripe from lower edge of eye to subopercle and a third continuing from maxillary streak to interopercle; pectoral-fin rays brown or greyish yellow, the membranes clear.

Geographical Distribution: *E. epistictus* is known from continental localities in the tropical Indo-West Pacific region. We examined specimens from the Gulf of Suez, Red Sea, Ethiopia, Zanzibar, Mozambique, South Africa (Natal), Oman, west coast of India, Japan, Taiwan, Hong Kong, China (Fujian Province), Viet Nam, Indonesia, Papua New Guinea, and northern Australia. The species has also been reported from Kenya, Korea, and the Ogasawara Islands (Fig. 296).

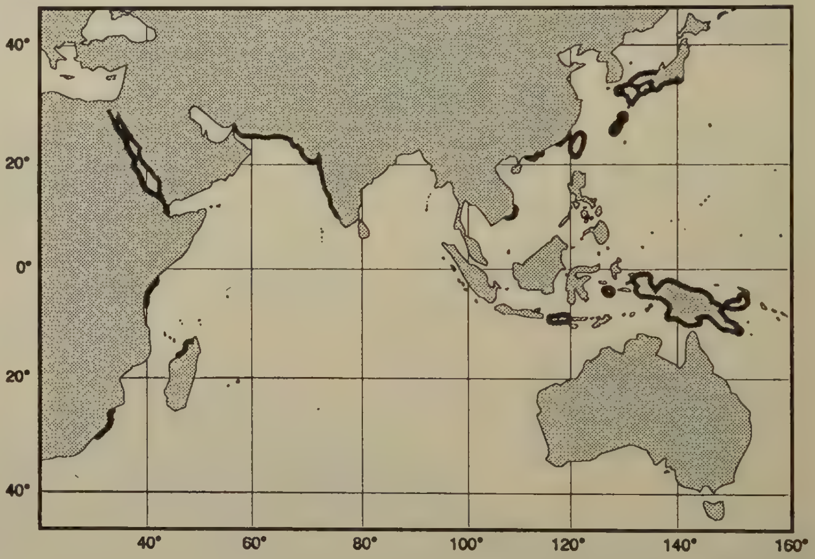


Fig. 296

Habitat and Biology: Rocky and trawlable bottoms in depths of 71 to 290 m. Nothing has been published on the biology of *E. epistictus*.

Size: Maximum size about 80 cm total length (7 kg).

Interest to Fisheries: Probably of some commercial importance, but separate catch statistics are not available for *E. epistictus*. Caught with trawls and handlines.

Local Names: SOUTH AFRICA: Brown rockcod; JAPAN: Komon-hata; HONG KONG: Black-spotted grouper, Huk-dim-paan; AUSTRALIA: Black-spotted rockcod.

Literature: Boulenger (1895:207, pl.5); Randall and Heemstra (1991).

Remarks: Specimens of *E. epistictus* from the Indian Ocean usually have fewer lateral-line scales (55 to 66) compared with fish from Japan and Taiwan (65 to 70), but one from Viet Nam and another from Indonesia have counts of 62 and 59. Specimens from the Indian Ocean also have smaller spots than those in the western Pacific and they are usually absent on the median fins.

E. heniochus is similar to *E. epistictus*, but it has fewer lateral-scale series (89 to 100), the dark spots on the body (if present) are faint and smaller than nostrils and the fins are unspotted; also the juveniles do not have 3 longitudinal rows of dark spots on head and body.

The illustration of a juvenile "*Epinephelus epistictus*" by Heemstra and Randall (1984) is of a juvenile *E. latifasciatus*.

Epinephelus ergastularius Whitley, 1930

Fig. 297; Pl. XIIF

SERRAN Epin 72

Epinephelus ergastularius Whitley, 1930:119, pl. 14, fig. 1 (type locality: off Long Bay, near Sydney, Australia).

Synonyms: None.

FAO Names: **En** - Sevenbar grouper; **Fr** - Mérou sept raies; **Sp** - Mero de siete bandas.

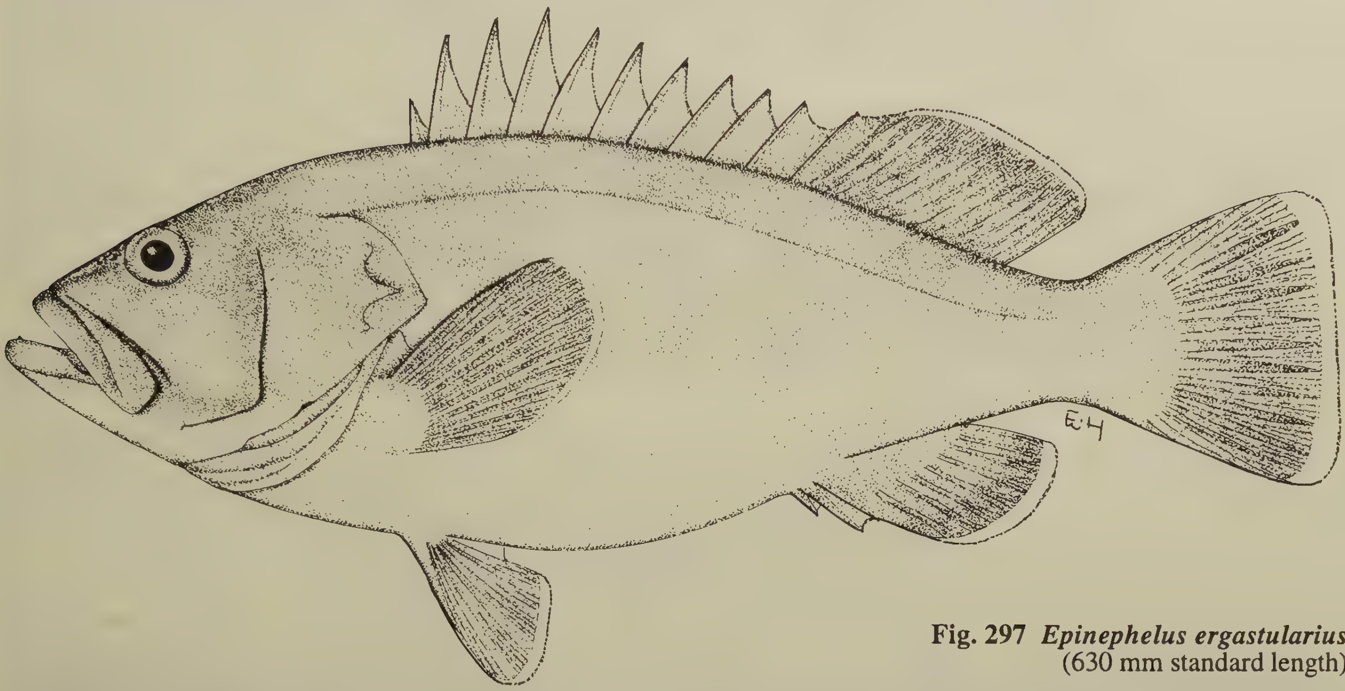


Fig. 297 ***Epinephelus ergastularius*** (630 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 2.9 times in standard length (for fish 19 to 89 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area and dorsal head profile slightly convex; preopercle subangular, finely serrate, the serrae on the rounded corner not enlarged and the ventral edge with 1 to 4 small serrae; upper edge of operculum almost straight; posterior nostrils 2 to 4 times larger than anterior nostrils; maxilla reaches to or almost to vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 9 on upper limb, 14 or 15 on lower limb; sides of gill arch with small bony tooth plates. Dorsal fin with XI spines and 14 or 15 rays, the third spine usually longest, its length contained 2.6 to 3.2 times in head length and subequal to length of longest ray, the interspinous membranes deeply incised; anal fin with III spines and 9 or 10 rays; pectoral-fin rays 18 or 19; pectoral-fin length contained 1.7 to 2.4 times in head length; pelvic fins distinctly shorter than pectoral fins; caudal fin slightly rounded in juveniles, truncate to slightly emarginate in adults. Lateral-body scales ctenoid; no auxiliary scales; lateral-line scales 63 to 70; lateral-scale series 103 to 116. **Colour**: Body of juveniles brown, with 7 broad dark bars, the last covering most of caudal peduncle, its upper half black; prominent black maxillary streak; median and pelvic fins dark brown; pectoral fins brown. Adults pinkish grey, with no trace of dark bars; fins darker than body and with white margins (except along spinous part of dorsal fin).

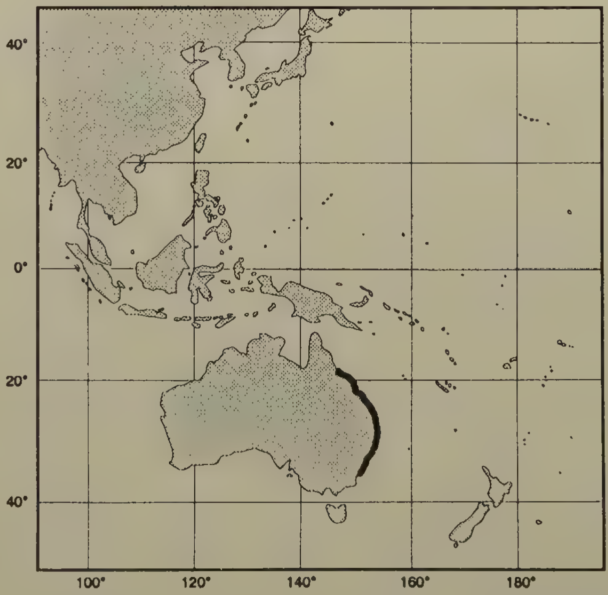


Fig. 298

Geographical Distribution: *E. ergastularius* is known only from the east coast of Australia between 18° and 36°S (Fig. 298).

Habitat and Biology: Adults are caught in depths of 108 to 370 m; juveniles are found in 15 to 128 m.

Size: Attains at least 157 cm total length and a weight of 66 kg.

Interest to Fisheries: Commonly caught with hook-and-line off the coast of New South Wales.

Local Names: AUSTRALIA: Banded rockcod.

Literature: Randall et al. (1993); Randall and Heemstra (1991).

Remarks: *E. ergastularius* is closely related to *E. septemfasciatus* (which is known only from Japan, Korea, and China) and *E. octofasciatus* (known from South Africa to New Zealand). These two species have a convex caudal fin in adults, and apparently lack the fine dermal ridges that are present on the body of *E. ergastularius* at the base of the dorsal fin; also, the pale margins on the fins are poorly developed or absent in these other two species. Juveniles can be distinguished by the spacing of the dark brown bars on the body: on *E. ergastularis* the pale space separating the second and third dark bars and that between the fourth and fifth bars is distinctly narrower than the interspaces between the third and fourth or fifth and sixth bars; on *E. octofasciatus* all the pale interspaces are about the same width, and on *E. septemfasciatus* the pale interspaces are about the same width, except for that between the fifth and sixth dark bars, which is distinctly narrower than the others.

Epinephelus erythrurus (Valenciennes, 1828)

Fig. 299; Pl. XIIIA

SERRAN Epin 73

Serranus erythrurus Valenciennes in Cuv. and Val., 1828:320 (type locality: Malabardia).

Synonyms: *Epinephelus Townsendi* Boulenger, 1898:133 (type locality: Karachi, Pakistan).

FAO Names: **En** - Cloudy grouper; **Fr** - Mérou nébuleux; **Sp** - Mero nublado.

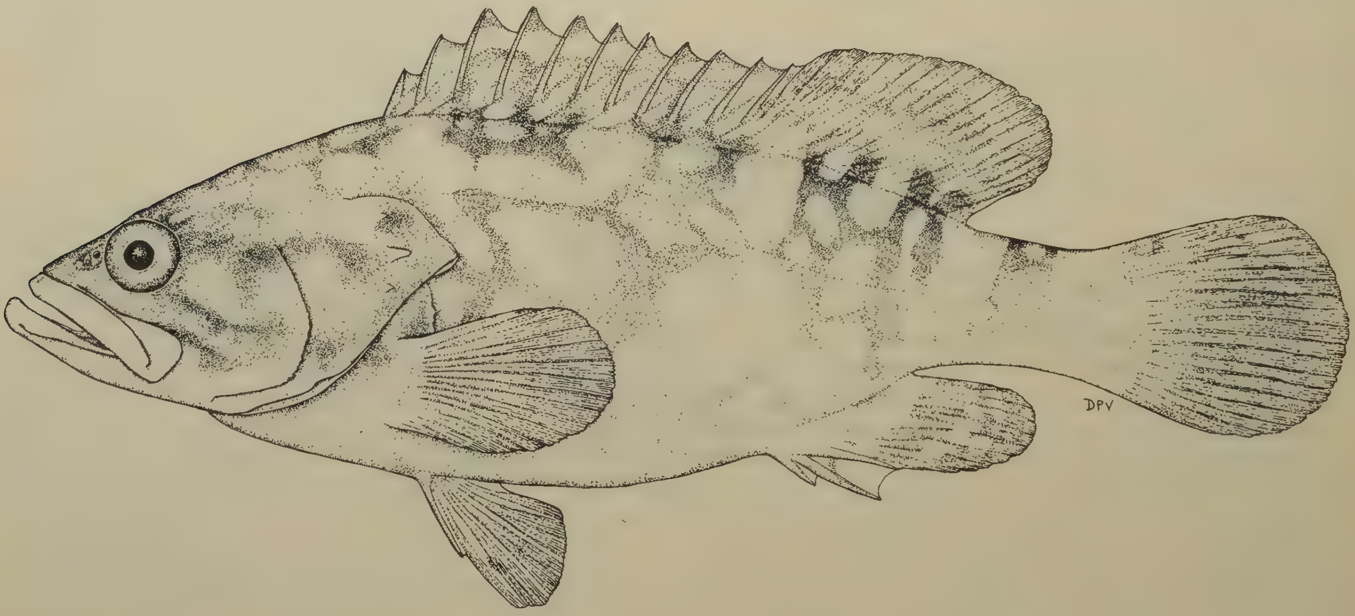


Fig. 299 ***Epinephelus erythrurus***
(176 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.2 times in standard length (for fish 11 to 28 cm standard length). Head length contained 2.4 to 2.7 times in standard length; interorbital area flat, the dorsal head profile almost straight; preopercle rounded, finely serrate, the lower serrae slightly enlarged; upper edge of operculum straight, except for bend at upper end; posterior nostrils about twice size of anterior nostrils; maxilla reaches to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth; canines at front of jaws inconspicuous. Gill rakers 8 or 9 on upper limb, 14 to 17 on lower limb; gill rakers shorter than gill filaments. Dorsal fin with XI spines and 15 to 17 rays, the third to ninth spines subequal, the longest contained 3.0 to 3.75 times in head length and distinctly shorter than longest ray; interspinous membranes of dorsal fin not incised or moderately incised; anal fin with III spines and 8 rays; pectoral fins with 17 to 19 rays; pectoral-fin length contained 1.7 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.3 to 2.5 times in head length; caudal fin well rounded. Lateral-body scales distinctly ctenoid, with auxiliary scales; lateral-line scales 53 to 62; lateral-scale series 92 to 107. Pyloric caeca about 6. **Colour**: Olive to reddish brown, usually with irregular pale spots and blotches that join randomly to form an irregular dark reticulum of the background colour; 3 dark streaks across operculum, first (broadest and darkest) from eye to lower edge of opercular flap, second from lower edge of eye to subopercle, and third (faintest) from dark maxillary streak to lower edge of preopercle; median and pelvic fins mottled; pectoral fins uniform. Some specimens, especially the larger ones, nearly uniform brown or with the pale blotches on body only faintly visible.

Geographical Distribution: *E. erythrurus* is known from Pakistan, India, Laccadive (Lakshadweep) Islands, Sri Lanka, Gulf of Thailand, Indonesia, Singapore, and Borneo (Fig. 300).

Habitat and Biology: Harbours and estuaries with muddy or silty-sand bottoms. Nothing has been published on the biology of *E. erythrurus*. We examined a fish of 163 mm standard length with ripe ova.

Size: Maximum size about 43 cm total length.

Interest to Fisheries: This species is of minor commercial importance. Caught with trawls, hook-and-line, and traps.

Local Names:

Literature: Randall and Heemstra (1991).

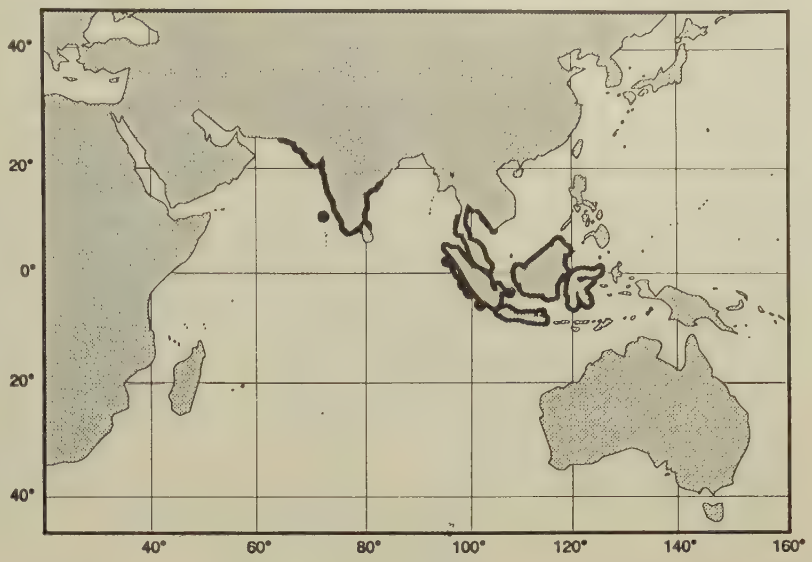


Fig. 300

Remarks: The painting identified as *Epinephelus nebulosus* in Bleeker's (1875-77) *Atlas* (Vol. 8, pl. 339, fig. 3) is undoubtedly *E. erythrurus*, but the holotype of *Serranus nebulosus* Valenciennes, 1828 appears to be a specimen of *E. coioides*.

Epinephelus exsul (Fowler, 1944)

Fig. 301

SERRAN Epin 62

Serrihastaperca exsul Fowler, 1944:385, figs 182 and 183 (type locality: eastern Pacific about 20 miles south of Mazatlan, Mexico).

Synonyms: None.

FAO Names: **En** - Tenspine grouper; **Fr** - Mérou dix épines; **Sp** - Mero diez espinas.

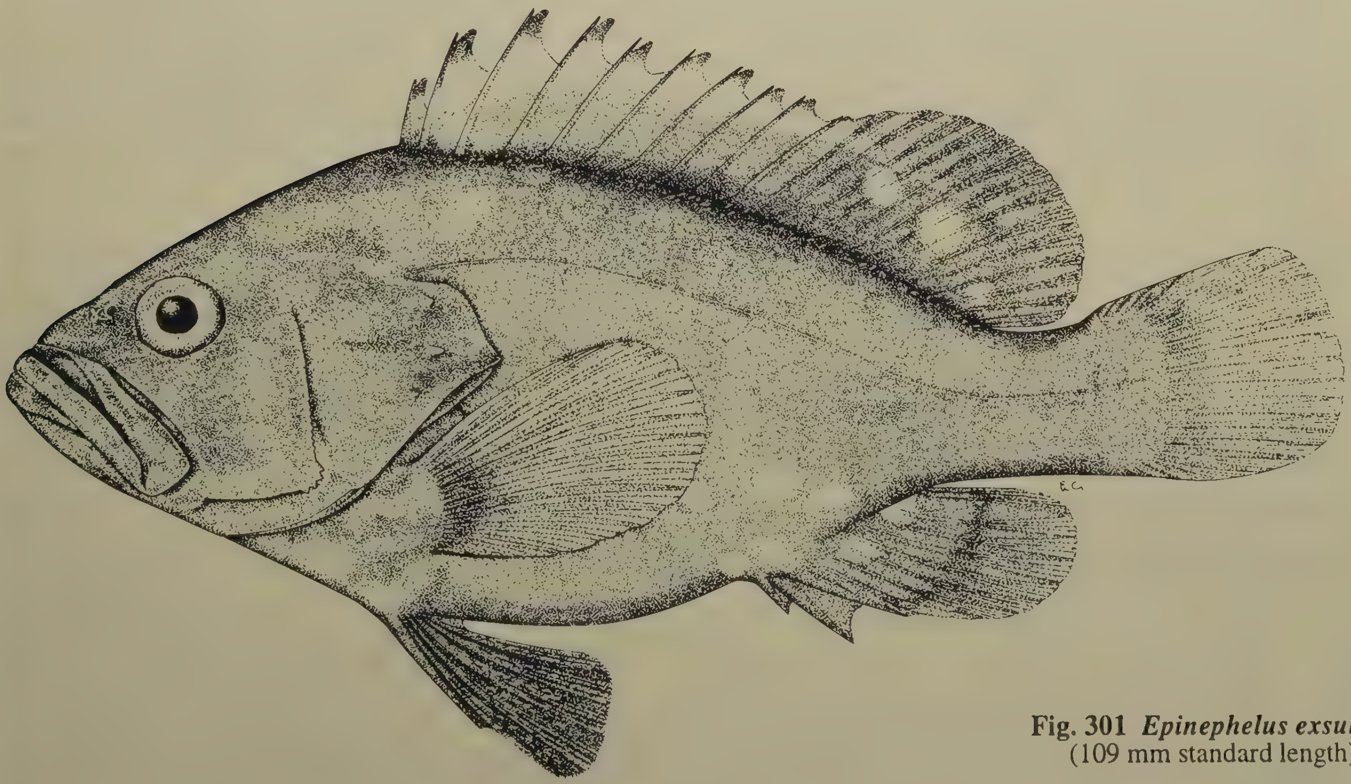


Fig. 301 *Epinephelus exsul*
(109 mm standard length)

Diagnostic Features: Body depth contained 2.3 times in standard length (2 fish of 104 and 109 mm standard length). Head length contained 2.2 to 2.3 in standard length; interorbital area convex; preopercle angular, with the serrae at the angle enlarged and with or without a few small serrae on lower edge; interopercle and subopercle smooth; rear nostrils larger than front ones and shaped like an inverted tear drop; maxilla reaches vertical at rear edge of eye. Gill rakers 8 to 10 on upper limb and 14 to 17 on lower limb, total 24 to 27. Dorsal fin with X spines and 13 or 14 rays, the interspinous membranes distinctly indented; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pelvic fins subequal to pectoral fins, pelvic-fin length contained 1.6 to 1.8 times in head length, the pelvic-fin origin anterior to pectoral-fin base; caudal fin rounded. Midlateral-body scales weakly ctenoid; lateral-line scales 64 to 68; lateral-scale series 87 to 92. **Colour**: In alcohol, juveniles with head and body brown, dorsal and anal fins darker; faint pale spots randomly scattered over body and dorsal and anal fins; pectoral fins and distal two-thirds of caudal fin paler than body; pelvic fins dark brown; black moustache streak present.

Geographical Distribution: Eastern Pacific from the Gulf of California to Panama (Fig. 302).

Habitat and Biology: The only information we have is that one of the juveniles we examined (SIO 65-164-35A from off Oaxaca, Mexico) came from a depth of 55 m.

Size: Known only from juveniles.

Interest to Fisheries: This species is apparently too rare to be of commercial interest.

Local Names:

Literature: C.L. Smith (1971, specimens from the eastern Pacific listed under "*Epinephelus nigritus*", but data from these specimens were not incorporated in Smith's diagnosis or tables).

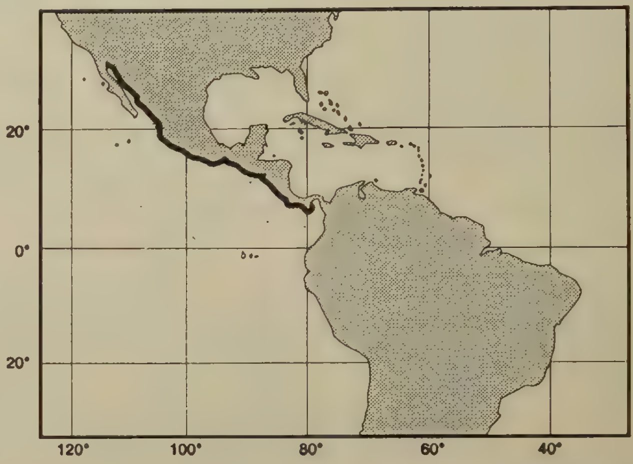


Fig. 302

Remarks: Heemstra (1974) decided that the post-larva described as ***Serrihastaperca exsul*** by Fowler (1944) from the Pacific coast of Mexico was "probably a species of ***Epinephelus***," but commented that "The troublesome part of this hypothesis is that ***S. exsul*** does not fit very well with any of the known eastern Pacific species of ***Epinephelus***." This holotype has a dorsal fin with X spines and 13 rays, anal fin with III spines and 8 rays, and pectoral fins with 19 rays. The fin counts of the 5 juveniles that we recently received on loan from the Scripps Institution of Oceanography agree with those of the holotype, except for having one more dorsal-fin ray. A range of 13 or 14 dorsal-fin rays is certainly within the bounds of intraspecific variation for grouper species; and in view of the agreement in other features, we regard these specimens (the 5 juveniles and the post-larval holotype) as conspecific.

E. exsul differs from all other eastern Pacific species of ***Epinephelus*** (except ***E. analogus***) in having X dorsal-fin spines. It differs from ***E. analogus*** in having fewer dorsal-fin rays (16 to 18 in ***E. analogus***), greater body depth (depth contained 2.6 to 3.0 times in standard length for ***E. analogus***), and very different colour pattern. ***E. nigritus*** of the western Atlantic differs in having 9 anal-fin rays, lateral-scale series 99 to 111, body depth contained 2.4 to 2.7 times in standard length, and pelvic fins longer than the pectoral fins.

Epinephelus fasciatomaculosus (Peters, 1866) Fig. 303; Pl. XIIIB SERRAN Epin 75

Serranus fasciatomaculosus Peters, 1866:111 (type locality: Nagasaki, Japan).

Synonyms: Often misspelt as ***Epinephelus fasciatomaculatus***.

FAO Names: **En** - Rock grouper; **Fr** - Mérou rocaille; **Sp** - Mero de las piedras.

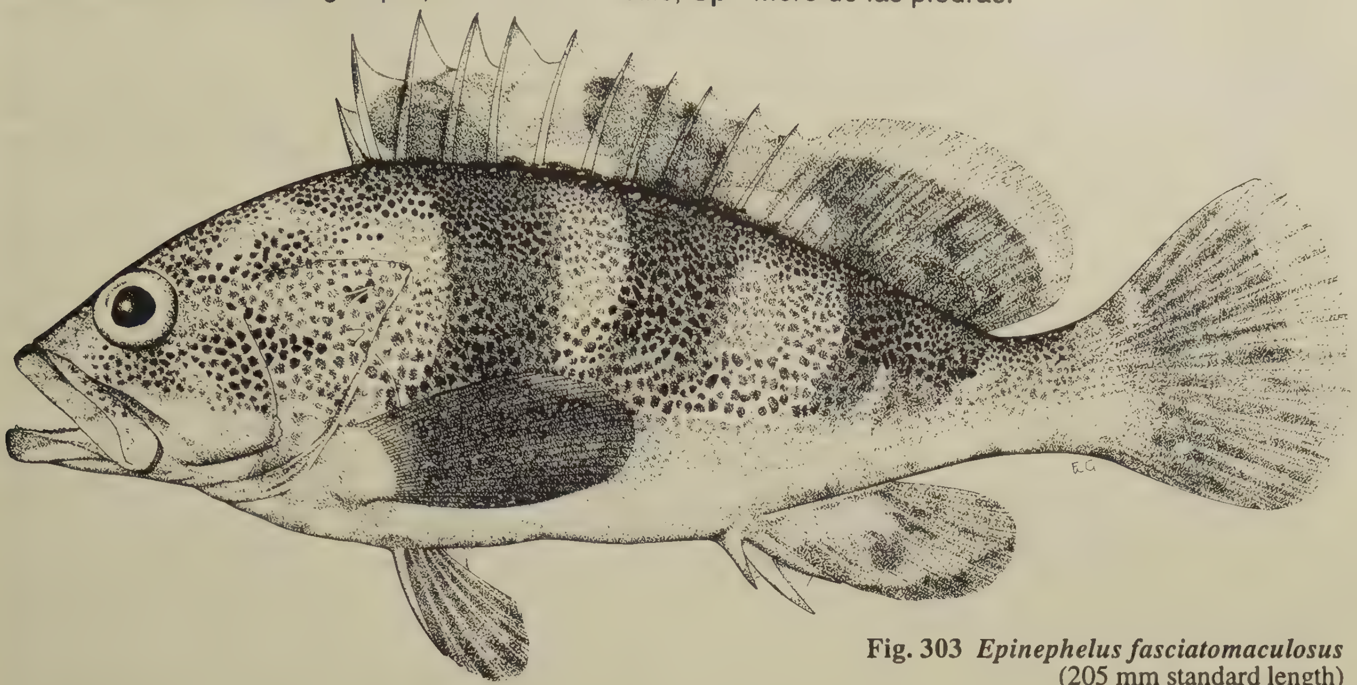


Fig. 303 *Epinephelus fasciatomaculosus* (205 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 9 to 29 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area and dorsal head profile slightly convex; preopercle angular, the serrae at the angle slightly enlarged; upper edge of operculum straight; nostrils subequal; maxilla reaches about to below rear third of eye or a little past eye; midlateral part of lower jaw with 2 or 3 rows of subequal teeth. Gill rakers 7 or 8 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.5 to 3.1 times in head length, and a little shorter than longest dorsal-fin rays, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic fins not reaching past anus, their length contained 1.9 to 2.3 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 52; lateral-scale series 92 to 106. **Colour**: Head and body pale greyish brown, with numerous small dark brown, brownish yellow, or russet spots; 3 to 5 slightly oblique broad dark bars usually visible on body, the last covering peduncle, the first 4 extending into dorsal fin; the first 2 bars are darker dorsally and extend to the margin of spinous dorsal fin; ventral parts of head and body whitish or pinkish; soft dorsal, caudal, and anal fins with faint pale spots and streaks; minute gold tag often visible at tips of some dorsal-fin spines. Dark body bars faint in adults and may be lost in preservative, except for dorsal part of first two bars.

Geographical Distribution: Western Pacific from southern Japan to Taiwan, Philippines, Viet Nam, China, Hong Kong, Hainan, and Sarawak (Fig. 304).

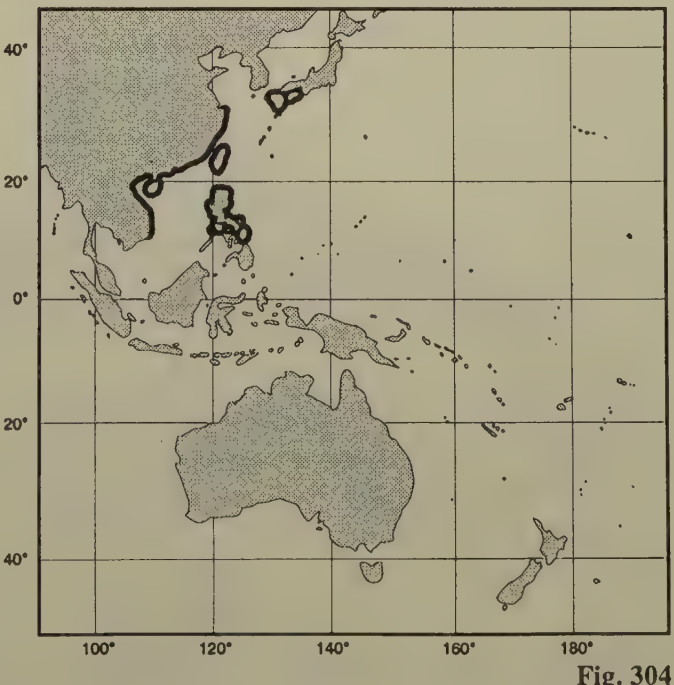


Fig. 304

Habitat and Biology: *E. fasciatomaculosus* occurs in shallow rocky areas. According to Chan (1968), it feeds on fishes, prawns, crabs, worms, and gastropods.

Age and growth and reproduction of Taiwanese fish were studied by Chen et al. (1980a and b, identified as "*Epinephelus diacanthus*"). Maximum size and age were 239 mm standard length at age 6. The von Bertalanffy growth equation was given as standard length = 228 $(1-e^{-0.3571(t+0.6993)})$. The weight/length equation was reported as $W = 1.621 \times 10^{-5}$ standard length$^{3.08968}$, where W is the weight in grammes of the eviscerated fish and standard length is in millimetre.

This species is protogynous. Females are mature at 125 mm standard length, and most sexual transition occurs in fish 2 or 3 years old (14 to 16 cm).

Fecundity ranged from 64 000 (age 1-year, 126 mm standard length) to 233 000 (age 6-years, 189 mm standard length) maturing ova per female.

Size: Maximum size is about 30 cm total length.

Interest to Fisheries: *E. fasciatomaculosus* is of some commercial importance in Hong Kong and Taiwan. Although a small species, it is excellent as a food fish and brings a good price. Caught with trawls, gill nets and hook-and-line.

Local Names: HONG KONG: Sek-dang; JAPAN: Obihata; SINGAPORE: Jiao zhi hou.

Literature: Randall and Heemstra (1991).

Remarks: In their *Colour Guide to the Fishes of the South China Sea and the Andaman Sea*, Tan et al. (1982) published a photograph of ***Epinephelus bleekeri*** on the plate opposite the species account for ***E. fasciatomaculosus***. But the correct photograph of ***E. fasciatomaculosus*** appears on the errata page supplied with their publication.

E. fasciatomaculosus is very similar to the sympatric ***E. akaara*** in meristic and most morphometric features. The dark bars on the body of ***E. akaara*** are fainter and they extend only onto the base of the dorsal fin; the prominent spots on the head and body are red, orange, or gold (pale in alcohol), and there are dusky yellow or orange spots on the spinous dorsal fin. Comparing fishes of 13 to 23 cm standard length, ***E. fasciatomaculosus*** has a slightly larger eye and more slender caudal peduncle (ratio of peduncle depth/eye diameter is 1.0 to 1.4, and in ***E. akaara*** it is 1.5 to 2.0).

Epinephelus fasciatus (Forsskål, 1775) Fig. 305; Pl. XIIIC-E SERRAN Epin 8

Perca fasciata Forsskål, 1775:40 (type locality: Red Sea).

Synonyms: ***Epinephelus marginalis*** Bloch, 1793:14, pl. 328, fig. 1 (type locality: East Indian seas). ***Holocentrus erythraeus*** Bloch and Schneider, 1801:320 (type locality: Red Sea). ***Holocentrus forskael*** Lacepède, 1802:337, 377 (substitute name for ***Perca fasciata*** Forsskål). ***Holocentrus marginatus*** Lacepède, 1802:384 (error for ***marginalis*** Bloch). ***Holocentrus rosmarus*** Lacepède, 1802:345, 389, pl. 7, fig. 2 (type locality: probably Indian Ocean). ***Holocentrus oceanicus*** Lacepède, 1802:345-46, 389, pl. 7, fig. 3 (type locality: probably Indian Ocean). ***Serranus Alexandrinus*** Valenciennes in Cuv. and Val., 1828:281 (type locality: Egypt [Red Sea]). ***Serranus variolosus*** Valenciennes in Cuv. and Val., 1828:354 (type locality: Tahiti). ***Serranus Tsirimen-ara*** Temminck and Schlegel, 1842:7, pl. 4 A, fig. 3 (type locality: Japan). ***Perca maculata*** Forster, 1844:220 (type locality: Tahuata, Marquesas). ***Serranus cruentus*** De Vis, 1884b:446 (type locality: New Britain). ***Serranus geometricus*** De Vis, 1885a:144 (type locality: Moreton Bay, Queensland). ***Serranus subfasciatus*** De Vis, 1885b:389 (type locality: Cardwell, Queensland). ***Epinephelus zapyrus*** Seale, 1906:36, fig. 11 (type locality: Tubuai, Austral Islands). ***Epinephelus emoryi*** Schultz, 1953:330, 340, fig. 52 (type locality: Bikini Atoll, Marshall Islands).

FAO Names: **En** - Blacktip grouper (formerly: Redbanded grouper); **Fr** - Mérou oriflamme; **Sp** - Mero banderilla.

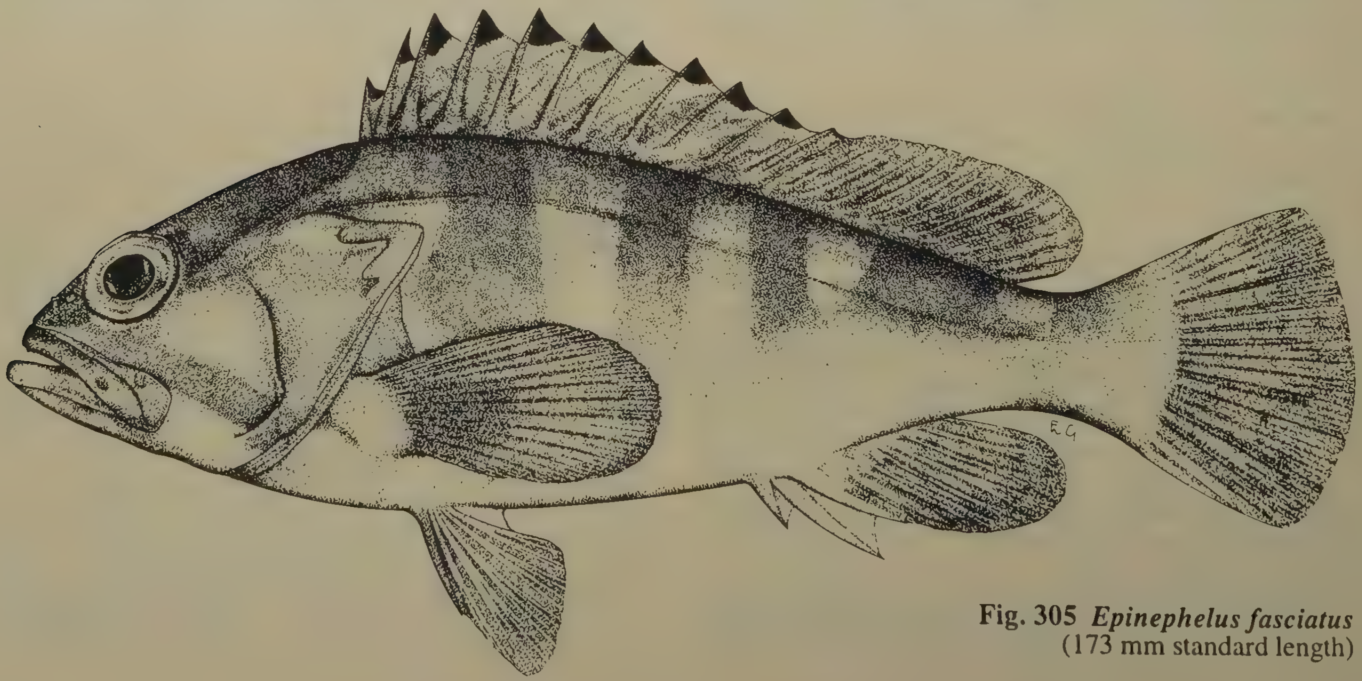


Fig. 305 ***Epinephelus fasciatus***
(173 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 10 to 26 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat, but dorsal head profile convex; snout length contained 4.3 to 5.1 times in head length; preopercle rounded, the rear edge finely serrate, with lowermost serrae slightly enlarged; upper edge of operculum straight; nostril subequal; maxilla reaches to below rear third of eye or a little past eye; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 6 to 8 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the 3rd to 11th spines subequal and slightly shorter than longest dorsal-fin ray; interspinous membranes of dorsal fin distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.5 to 2.0 in head length; pelvic fins not reaching past anus, their length contained 2.0 to 2.4 times in head length; caudal fin slightly to moderately rounded; central Pacific specimens often with truncate caudal fins. Lateral-body scales ctenoid, with numerous auxiliary scales; nape and dorsoposterior part of head densely covered with minute auxiliary scales; lateral-line scales 49 to 75; lateral-scale series 92 to 135 (see Remarks for discussion of variation in scale counts). Pyloric caeca 10 to 16. **Colour**: Ground colour varying from pale greenish grey, to pale reddish yellow to scarlet; body often with 5 or 6 faint dark bars, the last on peduncle; body scales (except ventrally) with pale centre and dark rear margin, producing a faint checked pattern; dorsal part of head and nape, including upper jaw, dark red or reddish brown or with bands and blotches of similar colour; often a dark band from below eye to interopercle; rim of orbit black and often bordered by a pale bluish line. Fins reddish orange, pale yellowish green, or greenish brown, the outer triangular part of interspinous membranes of dorsal fin black (dark red in fish from Western Australia and in some specimens from deep water), with pale yellow or white spot behind tip of each spine; soft dorsal, anal, and caudal fins often with pale yellow, white, or pale blue margins; pectoral fins may be yellowish distally. Pacific specimens usually with irregular pale or white blotches and spots on body (often a midlateral series diminishing in size posteriorly from behind pectoral-fin base to caudal peduncle) and a blackish brown line along crease of dorsal-fin base.

Geographical Distribution: *E. fasciatus* is one of the most common groupers in the Indo-Pacific region, and it is one of the two most widely distributed species of grouper in the world. *E. fasciatus* is known from the Red Sea and western Indian Ocean (south to Port Alfred, 33°36'S) to Fremantle, Western Australia, and in the Pacific it ranges from Japan (south of 33°) and Korea to southern Queensland and Lord Howe Island and eastward to the Pitcairn Islands. It occurs at most (virtually all) of the tropical and subtropical islands of the Indian Ocean and the west-central Pacific, but it is not known from Hawaii. Its absence from the Persian Gulf is puzzling (Fig. 306).

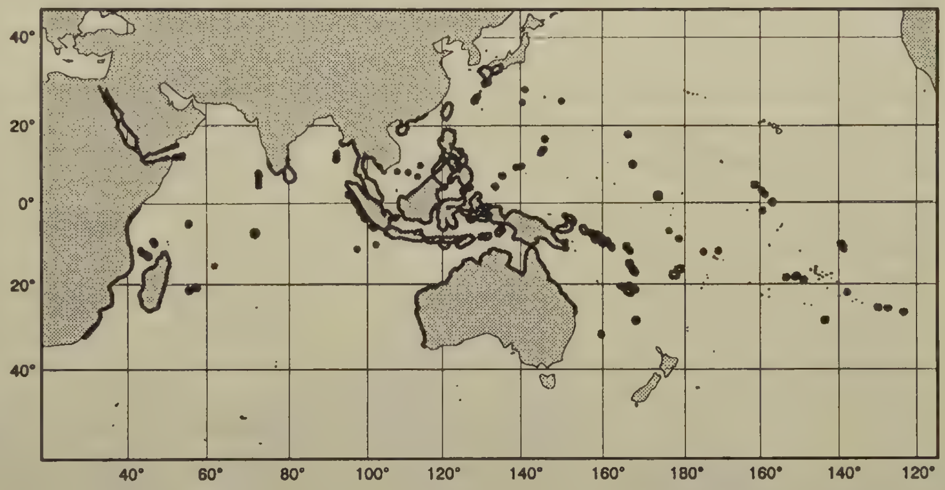


Fig. 306

Habitat and Biology: *E. fasciatus* is found on coral reefs and rocky bottom from the shore to depths of 160 m. At Madagascar it is one of the most abundant serranids at depths of 20 to 45 m, and it feeds during the day and night on brachyuran crabs, fishes, shrimps, and galatheid crabs in that order of importance (Harmelin-Vivien and Bouchon, 1976). Morgans (1982) reported that *E. fasciatus* from Kenyan waters ate crabs, stomatopods, fishes, ophiuroids, and octopus. Randall and Ben-Tuvia (1983) found that Red Sea specimens consumed mostly fishes and also some crustaceans (mainly crabs).

Size: Maximum total length about 40 cm.

Interest to Fisheries: Because of its abundance in shallow water, *E. fasciatus* is widely used for food. It is readily caught with hook-and-line, spear, traps, and gill nets.

Local Names: AUSTRALIA: Black-tipped rockcod, Footballer cod; INDIA: Teda (Marathi); JAPAN: Akahata; NEW CALEDONIA: Loche rouge; PHILIPPINES: Tangkaan (Visayan); SEYCHELLES: Vieille rouge; SINGAPORE: Kerapu bara, Lu gu hou.

Literature: Randall and Heemstra (1991).

Remarks: With such a wide distribution, it is not surprising that *E. fasciatus* exhibits considerable intraspecific variation. Based on scale counts and colour pattern, 6 populations can be distinguished:

1) Indian Ocean and Red Sea, 2) Western Australia, 3) Western Pacific, 4) Japan, 5) Pacific Plate islands, and 6) Marquesas Islands. Ranges of lateral-line scale counts for these populations are as follows: Red Sea, Indian Ocean and Western Australia 49 to 56 (n = 70); Western Pacific 49 to 54 (n = 31); Japan 55 to 61 (n = 11); Pacific Plate and Marquesas 59 to 75 (n = 46). The counts of lateral-scale series are as follows: Red Sea, Indian Ocean and Western Australia 91 to 123; Western Pacific 87 to 98; Japan 102 to 119; Pacific Plate 109 to 135; Marquesas 99 to 112 (n = 28). Specimens from Western Australia differ notably in colour, with the margin of the spinous dorsal fin dark red rather than black, as in most of the other *E. fasciatus*. At the Marquesas Islands, specimens have numerous irregular white spots scattered over the head and body.

E. fasciatus is one of 4 closely-related species, the other 3 being ***E. retouti***, ***E. rivulatus***, and ***E. irroratus***. These 4 species share similar distinctive features of their colour patterns: 1) Margin of spinous dorsal fin black or dark red (brown or gold in ***E. rivulatus***), 2) dark brown or red line along crease at base of dorsal fin, 3) body scales with a white, pale blue, or greenish grey spot or centre, and 4) orbit edged with black, red, or pale blue. These 4 species also have similar meristic and morphometric features.

In ***E. retouti*** the snout is longer (the length contained 3.5 to 3.9 times in head length), the caudal fin is truncate, the soft dorsal and upper fifth of caudal fin are dark olivaceous to dark greyish brown, the orbit rim is dark red ringed with pale blue; juveniles have the dorsal part of head black, crossed by 4 irregular whitish bands, and the first 3 dark bars on the body are black dorsally, the second and third bars extending into dorsal fin.

In ***E. rivulatus*** the body scale spots are conspicuous, there is a large semicircular red or reddish brown blotch at the base of the pectoral-fin rays and a similar spot anteriorly on isthmus.

In ***E. irroratus***, there are no dark bars on the body (which are usually more or less distinct in the other species) and the second dorsal-fin spine is distinctly elongated in adults.

Epinephelus faveatus (Valenciennes, 1828) Fig. 307; Pl. XIIIF SERRAN Epin 49

Serranus faveatus Valenciennes in Cuv. and Val., 1828:329 (type locality: Sri Lanka).

Synonyms: ***Serranus bontoo*** Valenciennes in Cuv. and Val., 1828:334 (type locality: Vishakhapatnam, India).

FAO Names: **En** - Barred-chest grouper; **Fr** - Mérou écharpe; **Sp** - Mero bandeado.

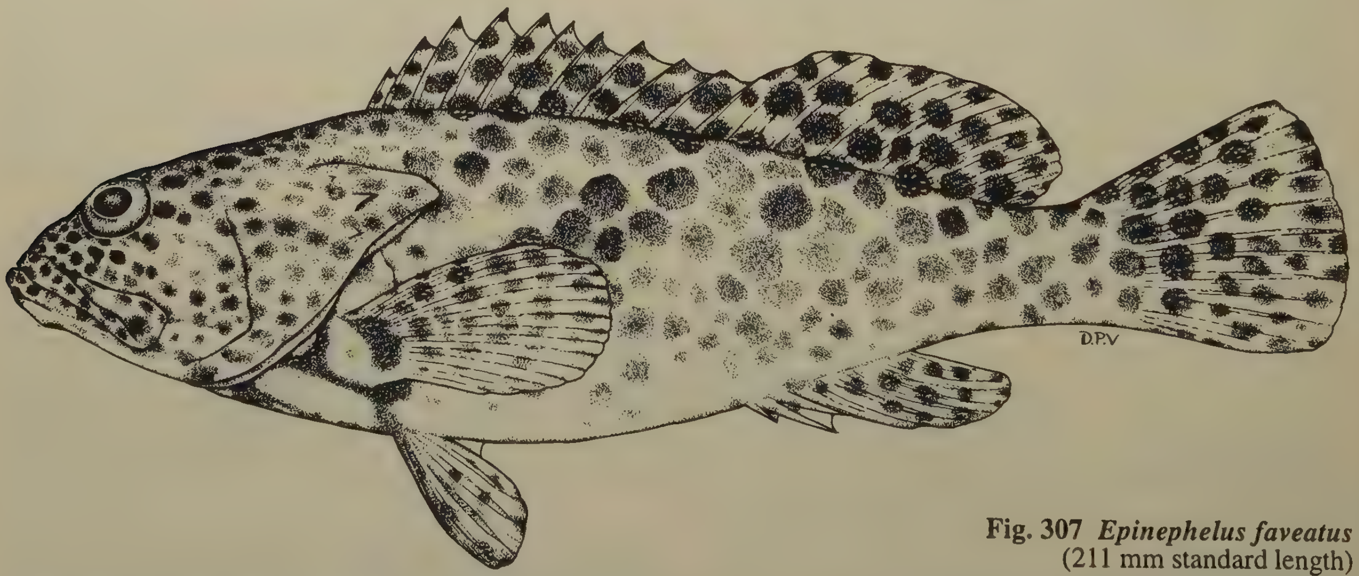


Fig. 307 *Epinephelus faveatus* (211 mm standard length)

Diagnostic Features: Body depth contained 3.0 to 3.5 times in standard length (for fish 9 to 26 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat or slightly concave, the dorsal head profile convex; preopercle rounded, with shallow indentation just above corner and slightly enlarged serrae at the corner; upper edge of operculum slightly convex; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 10 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest, its length contained 2.6 to 3.9 times in head length and shorter than longest dorsal-fin rays, the interspinous membranes incised; anal fin with III spines and 8 rays, the second and third spines subequal, their length contained 3.6 to 4.3 times in head length; pectoral-fin rays 17 to 19; pectoral-fin length contained

1.7 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.2 to 2.6 times in head length; caudal-peduncle depth contained 3.8 to 4.3 times in head length; caudal fin rounded; length of middle rays contained 1.65 to 1.9 times in head length. Lateral-body scales smooth (except for area covered by pectoral fin), with numerous auxiliary scales; lateral-line scales 48 to 52; lateral-scale series 83 to 98. Pyloric caeca about 25. **Colour**: Head, body, and fins pale, covered with close-set roundish brown spots of unequal size, most of those on body larger than pupil; 4 groups of 2 or 3 spots at base of dorsal fin darker than other spots on body; 2 oblique dark bands on side of chest; pectoral fins dusky, with dark blotch at the base and obscure dark spots more distinct on inner surface of fin; spots on median fins darker than those on body.

Geographical Distribution: Northeastern Indian Ocean: Southern India, (Trivandrum, Kovalam, Vizhinjam, Tuticorin, Mandapam and Madras), Sri Lanka (Negombo, Colombo, Hikkaduwa, Batticaloa and Trincomalee), and southern Indonesia (Bali and Lombok). *E. faveatus* has only recently been recognized and distinguished from similar species, so it is likely that its distribution is continuous from Pakistan to Indonesia. The record from the Chagos Archipelago by Winterbottom et al. (1989) is based on *E. macrospilos* (Fig. 308).

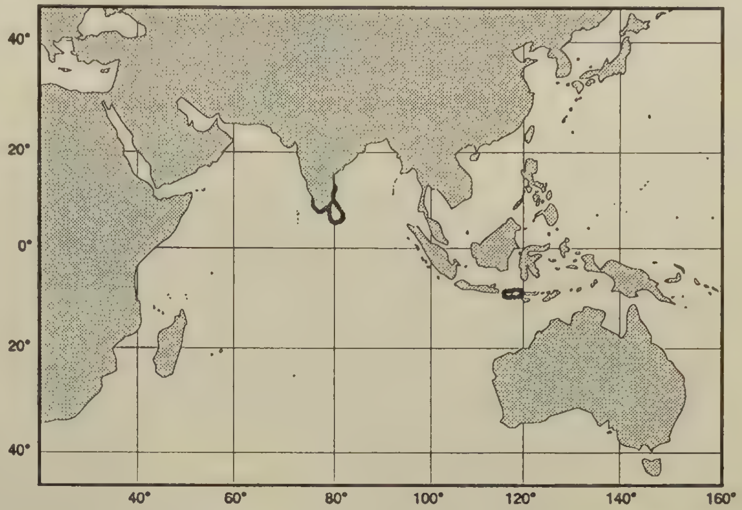


Fig. 308

Habitat and Biology: *E. faveatus* is a shallow-water species of coral reefs and rocky areas. It appears to be a small species; a 17 cm standard length fish from Sri Lanka (USNM 270893) has fairly well-developed ovaries.

Size: Maximum size known 32 cm total length.

Interest to Fisheries: Separate statistics are not available for this species, but it is undoubtedly of importance in local artisanal fisheries. Probably caught with hook-and-line, gill nets, lift-nets, traps, and spear.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: *E. faveatus* is one of 9 similar shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These "reticulated groupers" have been much confused in the literature, and many museum specimens have been misidentified. These other species differ from *E. faveatus* as follows:

E. bilobatus has the lateral-body scales ctenoid, a series of 3 bilobed dark blotches or close-set pairs of dark brown to black spots along base of dorsal fin and adjacent body, third or fourth dorsal-fin spine longest (its length contained 2.1 to 2.5 times in head length), and longest anal-fin spine contained 2.5 to 3.2 times in head length.

E. hexagonatus has the dark spots mostly hexagonal and partially merging, leaving only a conspicuous white triangular dot at each corner of the dark spots; no dark bands on chest; lateral-body scales ctenoid; lateral-line scales 61 to 70; and second anal-fin spine 2.1 to 2.5 times in head length.

E. macrospilos has 15 to 17 dorsal-fin rays, chest and pectoral-fin base with dark spots (not bands), and pectoral fins mostly dusky with pale edge.

E. maculatus has the dorsal-fin membranes not incised between the spines, pelvic-fin length contained 1.7 to 2.0 times in head length, lateral-body scales distinctly ctenoid, longest dorsal-fin spine contained 2.1 to 2.6 times in head length, and juveniles yellowish brown, with large irregular white blotches.

E. melanostigma has a large black blotch on body and dorsal fin at base of last 3 spines, no dark bands on chest, lateral-body scales ctenoid, lateral-line scales 57 to 61, and 3 to 5 rows of teeth at side of lower jaw.

E. merra has pectoral and median fins with prominent small dark spots (much smaller than spots on body), no dark bands on chest, lateral-body scales ctenoid, and lateral-scale series 98 to 114.

E. quoyanus has the lateral-body scales distinctly ctenoid, larger pectoral fins (their length contained 1.2 to 1.7 times in head length) and middle length of caudal-fin rays contained 1.3 to 1.6 times in head length.

E. spilotoceps has no dark bands on chest, spots on front of head less than twice size of nostrils, lateral-body scales ctenoid, lateral-line scales 59 to 69, and dorsal-fin rays 14 to 16.

Epinephelus flavocaeruleus (Lacepède, 1802)

Fig. 309; Pl. XIVA,B

SERRAN Epin 33

Holocentrus flavo-caeruleus Lacepède, 1802:335, 372 (type locality: Mauritius).

Synonyms: *Bodianus macrocephalus* Lacepède, 1802:291, 293 (type locality: Mauritius). ***Holocentrus gymnosus*** Lacepède, 1902:335, 372 (type locality: Mauritius). ***Serranus borbonicus*** Quoy and Gaimard, 1824:312, pl. 57, fig. 2 (type locality: Réunion). ***Perca flava-purpurea*** Bennett, 1830:pl. 19 (type locality: Sri Lanka). *Cynichthys flavo-purpuratus* Swainson, 1839:202, fig. 42c (emendation for ***Perca flava-purpurea*** Bennett).

FAO Names: **En** - Blue-and-yellow grouper; **Fr** - Mérou faraud; **Sp** - Mero azul y amarillo.

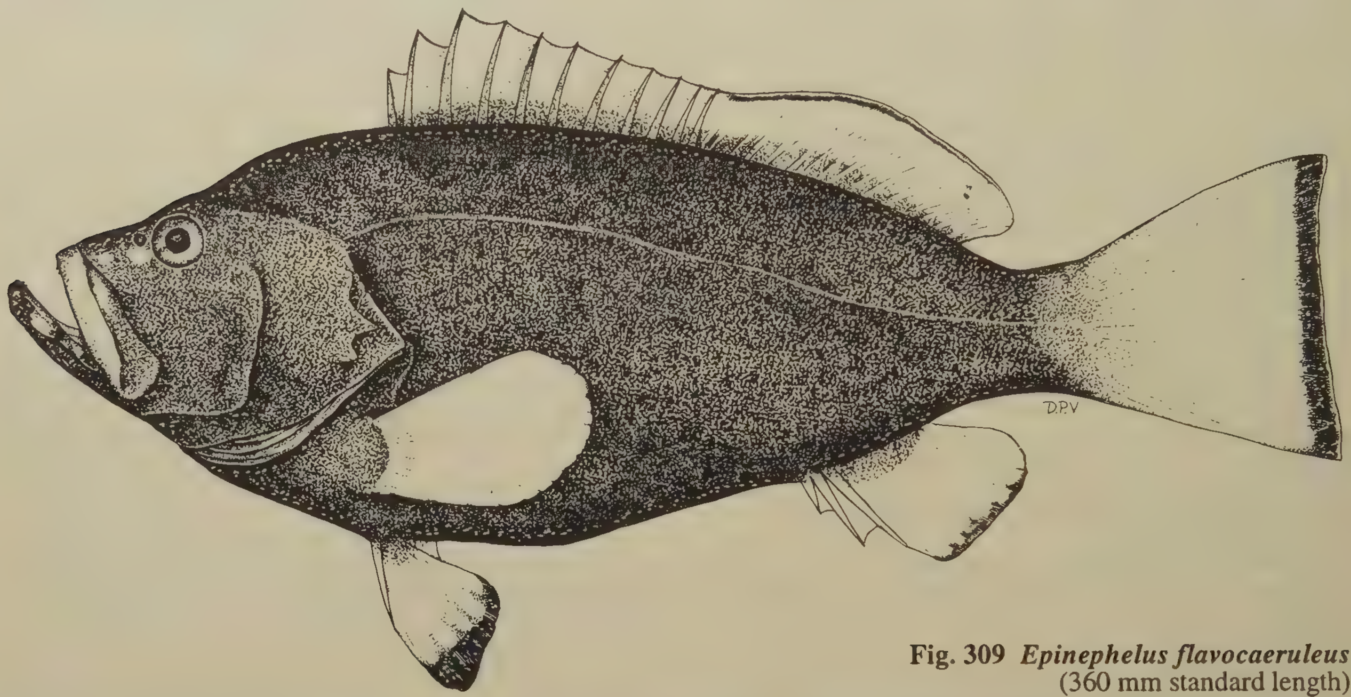


Fig. 309 ***Epinephelus flavocaeruleus***
(360 mm standard length)

Diagnostic Features: Body deep and compressed, the depth contained 2.3 to 2.7 times in standard length, body width contained 2.0 to 2.8 times in depth (for fish 13 to 66 cm standard length). Head length contained 2.4 to 2.7 times in standard length; preorbital depth contained 6.75 to 8.75 times in head length for fish 36 to 66 cm standard length; interorbital area convex; posterior nostrils of adults 4 or 5 times larger than anterior nostrils; preopercle subangular, the serrae at angle enlarged; upper edge of operculum straight or slightly convex; maxilla reaches to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.5 to 3.0 times in head length and subequal to longest rays, the interspinous membranes not incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.7 to 2.1 times in head length; pelvic fins not reaching anus (except in fish 15 cm standard length) but often longer than pectoral fins, its length contained 1.7 to 2.0 times in head length; caudal fin truncate. Lateral-body scales ctenoid, with a few auxiliary scales in adults; lateral-line scales 61 to 74; lateral-scale series 129 to 148.

Colour: Head and body dark bluish violet to dark greyish blue, sometimes flecked with pale blue; fins and jaws bright yellow; some fish with corners of caudal fin, margin of soft dorsal and anal fins and tips of pelvic fins blackish. Yellow diminishes with growth, and large adults are dark greyish, dark blue, violet, chestnut brown, or almost black.

Geographical Distribution: Indian Ocean from Djibouti south to Algoa Bay, South Africa (34°S) and eastward to the Andaman Sea and Sabang Island at the northwest tip of Sumatera (Sumatra), including Mozambique, Zanzibar, Kenya, Réunion, Mauritius, St. Brandon's Shoals, Seychelles, Lakshadweep Islands, Chagos, Rodriguez, Sri Lanka, and Andaman Islands (Fig. 310). *E. flavocaeruleus* is not known from the Red Sea or the Persian Gulf.

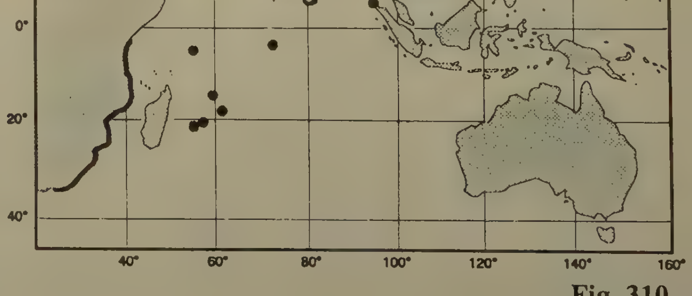


Fig. 310

Habitat and Biology: Juveniles of ***E. flavocaeruleus*** (to about 40 cm total length) are found on shallow coral reefs, but adults are more common on deeper reefs, to depths of 150 m. Feeds on a variety of fishes, crabs, shrimps, spiny lobsters, squids, and small octopuses. Females are mature at about 50 cm standard length (Morgans, 1982).

Size: Maximum size at least 80 cm total length and 9 kg.

Interest to Fisheries: Often found in the markets of Mombasa and Zanzibar. Caught with hook-and-line and spear.

Local Names: MAURITIUS: Vieille faraud; SEYCHELLES: Vieille plate; SRI LANKA: Kaha laveya, Manjel kaleva.

Literature: Van der Elst (1981); Morgans (1982); Randall and Whitehead (1985); Randall and Heemstra (1991).

Remarks: ***E. flavocaeruleus*** is closely related to ***E. multinotatus*** of the northern and western Indian Ocean, and ***E. cyanopodus*** of the western and central Pacific. These 3 species have similar meristic and morphological features, including a deep body, truncate caudal fin, interspinous dorsal-fin membranes not incised, pelvic fins subequal to pectoral fins, and posterior nostrils enlarged in adults; the only significant differences for these 3 species are their colour patterns. A fourth species, ***E. trophis***, known only from 2 juveniles collected off Western Australia, may also belong in this species complex. It has the same meristic and morphological characters, except the caudal fin is slightly convex, which is often the case in juveniles of species with truncate caudal fins; and it also differs in colour pattern from the other 3 species.

Epinephelus flavolimbatus Poey, 1865 Fig. 311; Pl. XIVC,D SERRAN Epin 15

Epinephelus flavolimbatus Poey, 1865:183 (type locality: Cuba).

Synonyms: None.

FAO Names: **En** - Yellowedge grouper; **Fr** - Mérou aile jaune; **Sp** - Mero aleta amarilla.

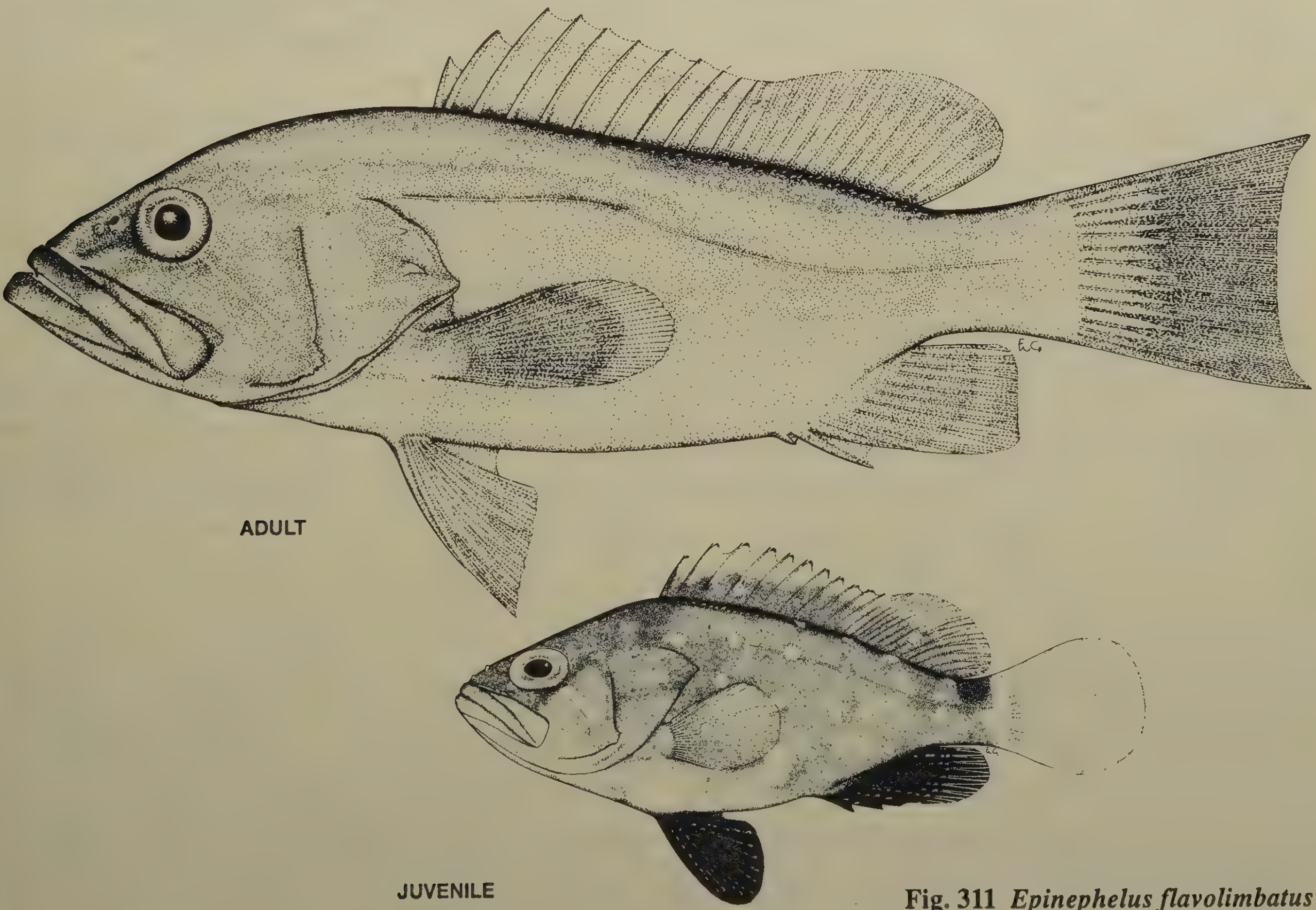


Fig. 311 ***Epinephelus flavolimbatus***
(adult 480 mm standard length, juvenile about 50 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.7 to 2.9 times in standard length (for fish 13 to 64 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area convex; preopercle angular, the serrae at angle distinctly enlarged and, in large fish, the angle is produced into a flat serrate lobe; eye diameter equal to or greater than interorbital width in fish less than 45 cm standard length; nostrils subequal. Gill rakers 8 or 9 on upper limb and 15 to 17 on lower limb, total 23 to 25. Dorsal fin with XI spines and 13 to 15 rays, the third or fourth spine longest and the membranes only slightly incised between the anterior spines; anal fin with III spines and 9 rays; pectoral-fin rays 17 or 18; rear margin of caudal fin convex in fish less than 30 cm standard length, truncate or slightly concave in larger fish. Lateral-body scales ctenoid; lateral-line scales about 65; lateral-scale series 82 to 99. **Colour**: Head and body buff or greyish brown, whitish ventrally; margins of dorsal and pectoral fins, and sometimes anal and caudal fins yellow (yellow margins reduced or absent in large adults); pale blue line from eye to corner of preopercle (very faint in adults). Juveniles 5 to 10 cm standard length with pearly spots arranged in 4 longitudinal rows and 7 vertical columns; dorsal fin with broad yellow margin; caudal fin white; anal and pelvic fins blackish; black saddle on peduncle (if present) ends abruptly at lateral line. Adults generally immaculate, but sometimes they may (momentarily) display the white-spotted grid pattern of juveniles.

Geographical Distribution: Western Atlantic from North Carolina to southern Brazil, including Gulf of Mexico and Caribbean; not known at Bermuda (Fig. 312).

Habitat and Biology: The yellowedge grouper is found in rocky areas and on sand/mud bottom in depths of 64 to 275 m. On soft bottoms they are often seen in or near trenches or burrow-like excavations. Females attain maturity at 52 to 60 cm total length and are thought to change sex at a total length of about 75 cm; the maximum age is at least 20 years. This species feeds on a wide variety of invertebrates (mainly brachyuran crabs) and fishes.

Size: Maximum total length about 115 cm; maximum weight at least 14 kg.

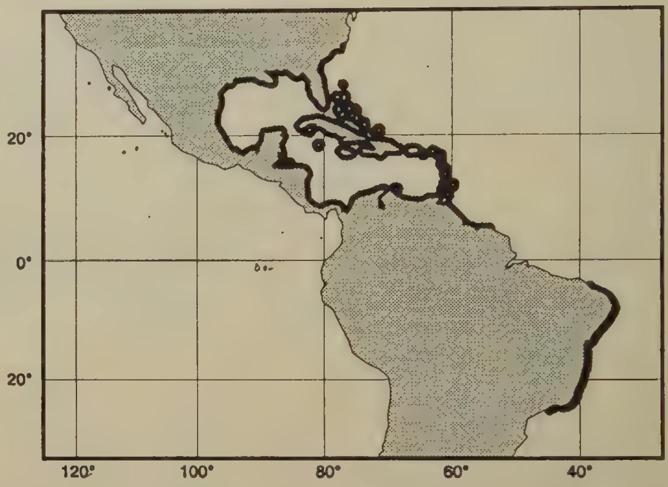


Fig. 312

Interest to Fisheries: *E. flavolimbatus* is one of the two most important species of groupers in the deep-water longline fishery in the eastern Gulf of Mexico. It is also of some importance in sport and commercial fisheries off the southeastern coast of the USA. This species seems to be rare in the Caribbean area.

Local Names: CUBA: Mero de aletas amarillas; MEXICO: Cherna del alto.

Literature: Rivas (1964); Smith (1971); Manooch (1984); Jones et al. (1989); Bullock and Smith (1991).

Remarks: *E. flavolimbatus* is similar to *E. niveatus* in fin counts and colour pattern of the juveniles; but juveniles of *E. flavolimbatus* have a blue line from eye to the corner of the preopercle, fewer white spots on the body, and the black saddle on the peduncle does not extend below the lateral line. In large juveniles and small adults of *E. flavolimbatus*, the spinous dorsal fin has a yellow or yellowish green margin, and the membrane is only slightly indented between the spines; but in *E. niveatus* the spinous part of the dorsal fin is uniformly coloured or with a blackish margin, and the interspinous dorsal-fin membranes are distinctly indented.

Epinephelus fuscoguttatus (Forsskål, 1775)

Fig. 313; Pl. XIVE

SERRAN Epin 9

Perca summana var. fusco-guttata Forsskål, 1775:41 (type locality: Suerens and Jeddah).

Synonyms: *Serranus horridus* Valenciennes in Cuv. and Val., 1828:321 (type locality: Jawa). *Serranus taeniocheirus* Valenciennes, in Cuv. and Val., 1830:518 (type locality: unknown). *Serranus lutra* Valenciennes in Cuv. and Val., 1831:474 (type locality: Mauritius).

FAO Names: **En** - Brown-marbled grouper; **Fr** - Mérou marron; **Sp** - Mero manchado.

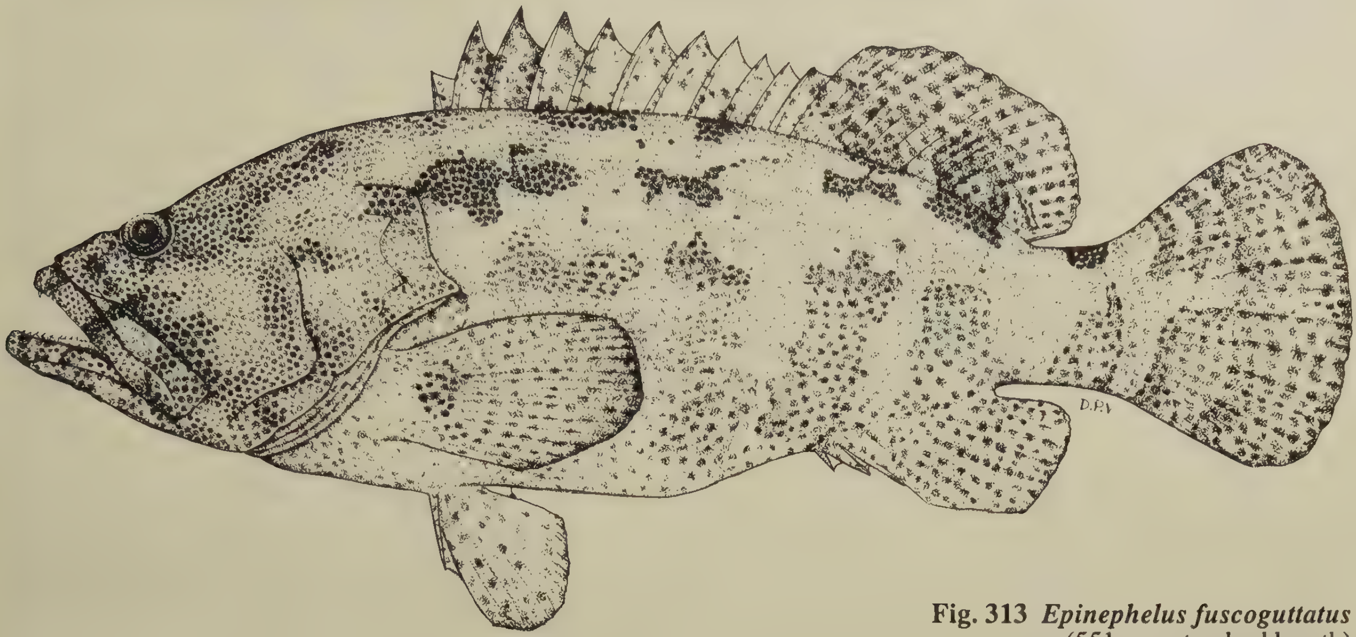


Fig. 313 ***Epinephelus fuscoguttatus***
(551 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 2.9 times in standard length (for fish 11 to 55 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat or slightly concave; dorsal head profile of adults indented at eyes and distinctly convex from there to dorsal-fin origin; preopercle rounded, finely serrate; upper edge of operculum distinctly convex, descending almost vertically to rear end of operculum; anterior edge of preorbital bone deeply indented below nostrils; posterior nostrils triangular, 4 to 7 times larger than anteriors in adults; maxilla extends well posterior to eye; midlateral part of lower jaw with 3 or 4 rows of teeth, the inner teeth about twice longer than outer teeth; canines inconspicuous; nostrils close together. Gill rakers 10 to 12 on upper limb, 17 to 21 on lower limb (but rudiments often difficult to count); gill rakers short and stout, raker at angle subequal to longest gill filaments, other rakers distinctly shorter. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.9 to 3.5 times in head length and distinctly shorter than longest dorsal-fin rays, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.7 to 2.1 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.5 times in head length; caudal fin rounded. Lateral-body scales of fish more than 10 cm standard length smooth, with auxiliary scales; lateral-line scales 52 to 58; lateral-scale series 102 to 115. **Colour**: Pale yellowish brown, with 5 vertical series of dark brown blotches that are very irregular in outline; head, body, and fins covered with close-set small brown spots, those on the dark blotches much darker than spots in between blotches; small black saddle spot on rear half of peduncle; 2 or 3 faint, dark bars at side of jaws.

Geographical Distribution: Widely distributed in the Indo-Pacific region, including the Red Sea, but not known from the Persian Gulf, Hawaii, or French Polynesia. *E. fuscoguttatus* occurs at most (probably all) of the tropical islands of the Indian and west-central Pacific oceans (east to Samoa and the Phoenix Islands) along the east coast of Africa to Mozambique, and it has also been reported from Madagascar, India, Thailand, Indonesia, tropical coast of Australia, Japan, Philippines, New Guinea, and New Caledonia (Fig. 314).

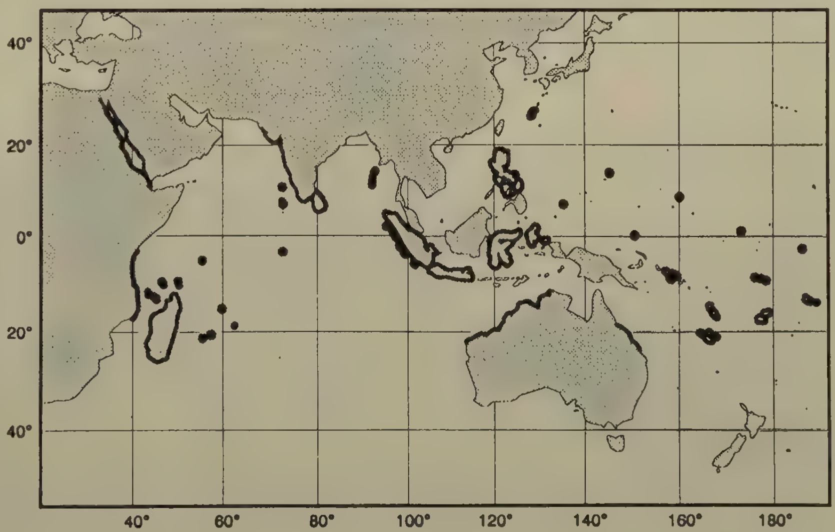


Fig. 314

Habitat and Biology: Shallow coral reefs and rocky bottoms to depths of 60 m; juveniles are found in seagrass areas. Reported stomach contents include fishes, crabs, and cephalopods. Although *E. fuscoguttatus* has been implicated in ciguatera fish poisonings at some localities in the Pacific, it has recently attracted interest as a candidate for aquaculture in Singapore.

Size: Maximum size at least 95 cm total length (120 cm in the Philippines according to Schroeder, 1980) and 11 kg.

Interest to Fisheries: Separate statistics are not reported for this species. Adults are not common, but this species is seen in local markets. Caught with hook-and-line, traps, and spear.

Local Names: AUSTRALIA: Flowery cod; INDIA (Lakshadweep Islands): Fana, Chammam; JAPAN: Aka-madarahata; PHILIPPINES: Garopa (Tagalog), Pugapo (Visayan); SEYCHELLES: Vieille crabbe, Vieille machatta; SINGAPORE: Tiger grouper, Marble grouper.

Literature: Morgans (1959, 1982); Randall (1964); Randall and Ben-Tuvia (1983); Heemstra and Randall (1984, 1986); Randall and Heemstra (1991).

Remarks: *E. fuscoguttatus* is often confused with ***E. polyphekadion*** (= ***E. microdon*** of recent authors; e.g., Kyushin et al., 1977; Grant, 1975), which has fewer pectoral-fin rays (16 or 17), usually fewer lower gill rakers (16 to 18), smoothly convex dorsal head profile, and interspinous dorsal-fin membranes less deeply incised.

Epinephelus gabriellae Randall and Heemstra, 1991

Fig. 315; Pl. XVIF

SERRAN Epin 77

Epinephelus gabriellae Randall and Heemstra, 1991:145, pl. 14, fig. A; pl. 36, figs A and B; fig. 78 (type locality: Arabian Sea, Oman, near Mirbat; 16°58'0"N, 54°42'50"E).

Synonyms: *Epinephelus* sp. Amaoka et al., 1976:131, fig. "Arb-25" (Somalia).

FAO Names: **En** - Multispotted grouper; **Fr** - Mérou passoire; **Sp** - Mero pintitas.

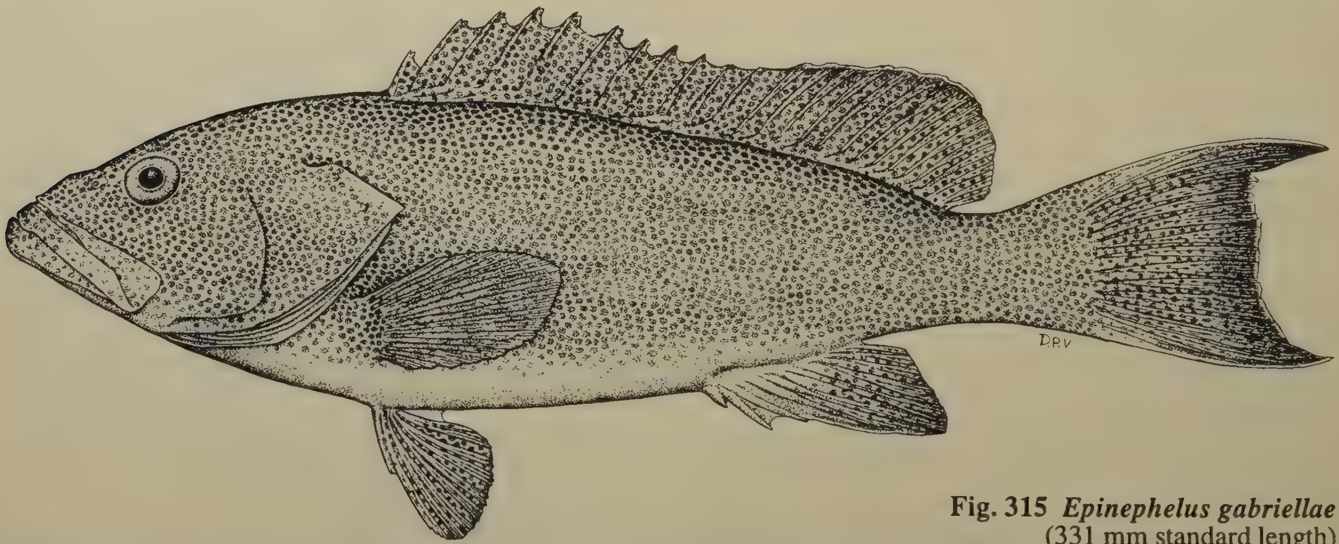


Fig. 315 ***Epinephelus gabriellae***
(331 mm standard length)

Diagnostic Features: Body depth contained 3.2 to 3.6 times in standard length (for fish 11 to 39 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat to slightly convex, the dorsal head profile with slight indentation above nostrils; preopercle angular, with enlarged serrae at angle and a shallow notch just above angle; upper edge of operculum straight; posterior nostrils slightly larger than anteriors; maxilla reaches vertical at rear edge of eye; ventral edge of maxilla with a low step-like bend an orbit diameter from rear end of bone; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 10 to 12 on upper limb, 17 to 19 on lower limb, no rudiments. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, contained 2.7 to 3.6 times in head length, slightly shorter than longest rays; anal fin with III spines and 8 rays, the fin margin angular; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.4 times in head length; caudal-peduncle depth contained 3.5 to 3.9 times in head length, 10.5 to 11.3% of standard length; caudal fin emarginate to concave, the concavity 5 to 15 times in head length. Lateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 52 to 54; lateral-scale series 106 to 126. Pyloric caeca about 76. **Colour**: Head and body pale brownish grey, densely covered (except ventrally) with tiny, close-set dark orange-brown spots; median and paired fins spotted like body; caudal, soft dorsal, and anal fins with white edge and submarginal blackish zone.

Geographical Distribution: Northern Indian Ocean from Somalia to Oman (Fig. 316).

Habitat and Biology: *E. gabriellae* occurs on rocky bottom in depths 40 to 88 m; a 22 cm standard length immature female was taken in 6 to 8 m with rotenone. Another specimen was caught trolling, presumably near the surface, off the coast of Somalia.

Size: Attains at least 39 cm standard length.

Interest to Fisheries: Probably of some importance along the coasts of Oman, Yemen and Somalia, but *E. gabriellae* has only recently been described as a new species, hence records of landings are wanting. Juveniles and subadults are the second most common species of grouper on inshore rocky areas along the southern coast of Oman. Caught with trawls and hook-and-line.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: *E. gabriellae* is closely related to *E. chlorostigma*, which also has a similar colour pattern, subangular preopercle with serrae not much enlarged at the angle, gill arches with numerous small platelets, maxilla with a low step on the ventral edge, operculum with a straight upper edge, 2 rows of teeth on sides of lower jaw, anal fin angular in adults, caudal fin truncate or emarginate, and similar scale counts. But *E. chlorostigma* differs in having more dorsal-fin rays (16 to 18), deeper body (depth contained 2.8 to 3.3 times in standard length), deeper caudal peduncle (peduncle depth contained 3.0 to 3.6 times in head length), shorter pelvic fins (length contained 1.7 to 2.25 times in head length), and minor differences in colour pattern: spots dark brown and slightly larger, outer surface of pectoral fins distinctly spotted, and no white margins on the median fins. *E. polylepis* also has a similar colour pattern and an emarginate caudal fin. But it has more scales (lateral-line 65 to 72, lateral-scale series 126 to 142), 16 or 17 dorsal-fin rays, a deeper body (depth contained 2.6 to 3.3 in standard length), and the caudal fin of adults is usually less concave (concavity 9 to 33 times in head length).

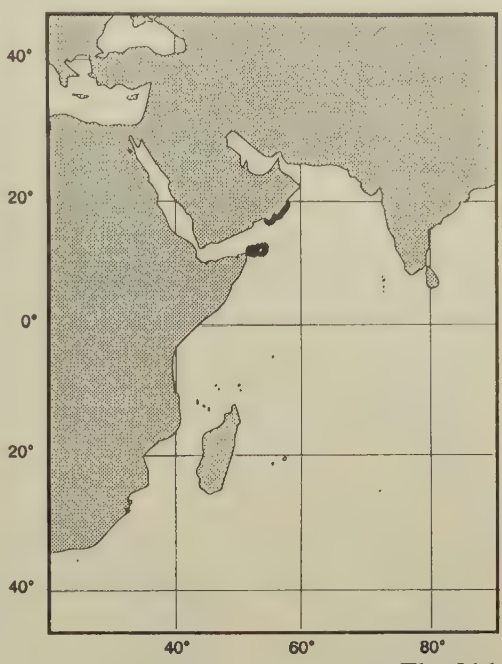


Fig. 316

Epinephelus goreensis (Valenciennes, 1830)

Fig. 317; Pl. XVA

SERRAN Epin 25

Serranus goreensis Valenciennes in Cuv. and Val., 1830:511 (type locality: Gorée [Dakar] Sénégal; syntypes MNHN 7323, 7324).

Synonyms: None.

FAO Names: **En** - Dungat grouper; **Fr** - Mérou de Gorée (formerly: Mérou dungat); **Sp** - Mero de Gorea.

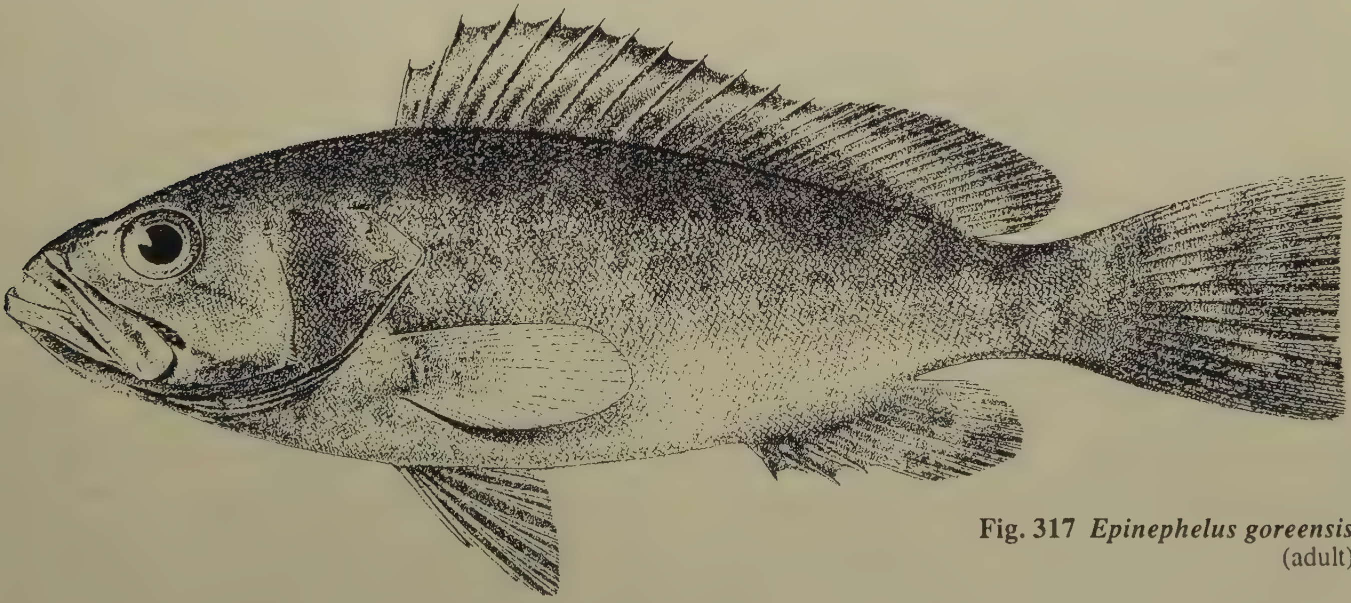


Fig. 317 *Epinephelus goreensis* (adult)

Diagnostic Features: Body depth less than head length, depth contained 2.9 to 3.2 times in standard length (for fish 22 to 50 cm standard length). Head length contained 2.5 to 2.7 times in standard length; interorbital area flat or slightly convex; preopercle angular, with 3 or 4 enlarged serrae at the angle, the lowermost directed ventrally; interopercle and subopercle serrate; middle and lower opercular spines well developed, the upper spine not apparent; upper edge of operculum approximately straight; maxilla reaches vertical at rear edge of eye; no step on ventral edge of maxilla; maxilla naked or with a few minute scales dorsally; midlateral part of lower jaw with 2 rows of teeth; rear nostrils about twice the size of anterior nostrils. Gill rakers 8 or 9 on upper limb, 16 or 17 on lower limb, total 24 to 26; longest gill raker longer than longest gill filaments. Dorsal fin with XI spines and 16 rays, the third or fourth spine longest but shorter than longest ray, the fin membrane incised between the spines; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19, pectoral-fin length contained 1.8 to 2.1 times in head length; pelvic fins shorter than or equal to pectoral fins; caudal fin slightly concave, truncate or slightly convex. Lateral-body scales ctenoid; no auxiliary scales; lateral-line scales 68 to 74; lateral-scale series 120 to 129. Pyloric caeca 13, long and slender. **Colour:** Head and body brownish; 3 or 4 broad, oblique, dark bars on dorsal part of body and another on dorsal half of peduncle; 2 narrow, faint dark bands extending posteriorly from lower half of eye; dark moustache streak present, but not extending past rear end of maxilla.

Geographical Distribution: *E. goreensis* is known from the tropical coast of west Africa from Senegal to southern Angola. The species has also been reported from the Canary and Cape Verde Islands, but Alberto Brito informed us that *E. goreensis* has never been caught in the Canary Islands (Fig. 318).

Habitat and Biology: Poll (1954) reported this species from a variety of habitats (rock, mud and sand) at depths of 80 to 100 m. No information has been published on the biology of *E. goreensis*.

Size: Maximum size unknown; attains at least 55 cm total length.

Interest to Fisheries: Probably of importance to subsistence fisheries where it occurs.

Local Names: ANGOLA: Garopa petto; CAPE VERDE ISLANDS: Peisce bodi; MAURITANIA: Madeija; SENEGAL: Sandovika, Doï.

Literature: Steindachner (1882); Boulenger (1895); Heemstra (1991).

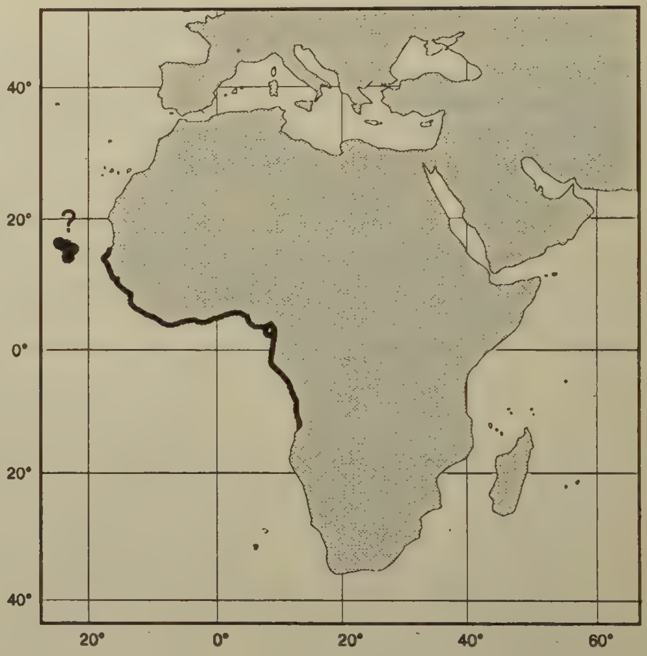


Fig. 318

Remarks: The dark markings that help to identify juveniles are probably not visible on large adults. *E. goreensis* is most similar to *E. costae*. Juveniles of *E. costae* have 3 to 5 narrow dark stripes paralleling the lateral line (no dark stripes in *E. goreensis*), and adults often have a large golden yellow blotch on body below the spinous dorsal fin. *E. goreensis* is readily separated from *E. caninus*, which has only 13 or 14 dorsal-fin rays and usually a larger head (length contained 2.3 to 2.5 times in standard length). In addition to the characters in the key to Eastern Atlantic species of *Epinephelus* (given above), *E. goreensis* differs from *E. marginatus* in having a smaller head (length contained 2.5 to 2.7 versus 2.3 to 2.5 times in standard length), more lower-limb gill rakers (16 or 17 versus 14 to 16), and a ventrally directed spine at the angle of the preopercle.

Epinephelus guttatus (Linnaeus, 1758) Fig. 319; Pl. XVB SERRAN Epin 16

Perca guttata Linnaeus, 1758:292 (type locality: America).

Synonyms: ?***Holocentrus punctatus*** Bloch, 1790:88, pl. 241 (after Marcgrave, type locality probably Brazil). ***Lutianus lunulatus*** (non Park) Parra in Bloch and Schneider, 1801:329 (based on ***Cabrilla*** Parra, 1787:93, pl. 36, fig. 1; type locality: Cuba). ***Serranus maculosus*** Valenciennes in Cuv. and Val., 1828:31 (type locality unknown). ***Serranus catus*** Valenciennes in Cuv. and Val., 1828:373 (type locality: Martinique). ***Serranus arara*** Valenciennes in Cuv. and Val., 1828:377 (type locality: Cuba). ***Epinephelus cubanus*** Poey, 1866:202 (type locality: Cuba). ***Serranus Stathouderi*** Vaillant, 1877:69 in Vaillant and Bocourt, 1874-1915, (substitute for ***Serranus maculosus*** Valenciennes, 1828; type locality: unknown).

FAO Names: **En** - Red hind; **Fr** - Mérou couronné; **Sp** - Mero colorado.

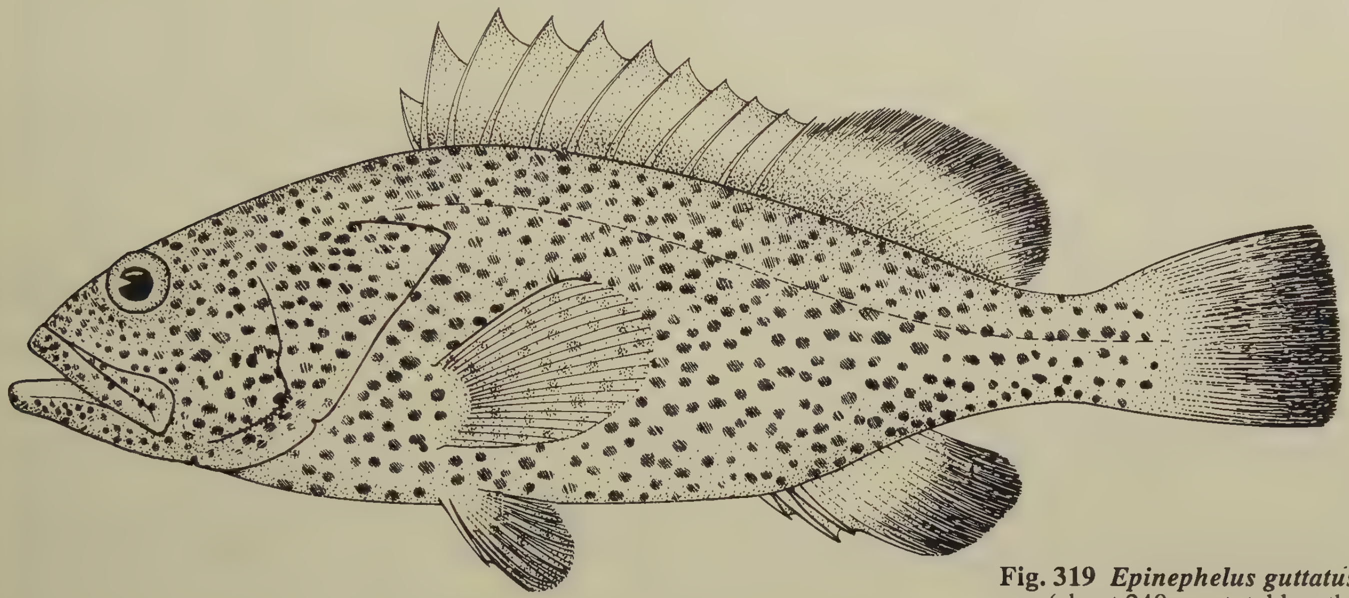


Fig. 319 ***Epinephelus guttatus***
(about 240 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.7 to 3.1 times in standard length (for fish 17 to 38 cm standard length). Head length contained 2.3 to 2.4 times in standard length; preopercle evenly serrate, without salient angle; posterior nostrils larger than anteriors. Gill rakers 8 or 9 on upper limb, 16 to 18 on lower limb, total 24 to 26. Dorsal fin with XI spines and 15 or 16 rays, the third or fourth spine longest, the interspinous membrane incised and produced into a short flag behind tip of each spine; anal fin with III spines and 8 rays; pectoral-fin rays 16 to 18; rear edge of caudal fin rounded. Lateral-body scales ctenoid, 92 to 104 lateral-scale series. **Colour**: Ground colour buff, greenish white, or pale reddish brown, the head and body covered with bright red spots, the dorsal spots reddish brown; spinous dorsal fin olive with yellow flags at tips of the spines; soft dorsal, caudal, and anal fins olivaceous, with a broad blackish submarginal band and narrow pale edge; pectoral fins pale orange-red with darker red spots on the base; pelvic fins coloured like body but darker distally and along leading edge.

Geographical Distribution: Tropical western Atlantic, ranging north to North Carolina and south to Venezuela; the most common species of ***Epinephelus*** in the West Indies (Fig. 320).

Habitat and Biology: Shallow reefs and rocky bottoms in depths of 2 to at least 100 m. According to Randall (1967) red hind feed mainly on crabs (40%), other crustaceans (27%), fishes (21%), and octopus (7%). The crabs taken belong to the genera *Calapa* and *Mithrax*, the other crustaceans are mainly alpheid shrimps and scyllarid lobsters; preferred reef fishes are labrids and haemulids. Luckhorst et al. (1992) reported a 72 cm total length specimen from Bermuda that was estimated to be 22 years old. Females become mature at 22 to 24 cm total length, and sexual inversion occurs for some fish at 28 cm total length; most fish larger than 40 cm are males.

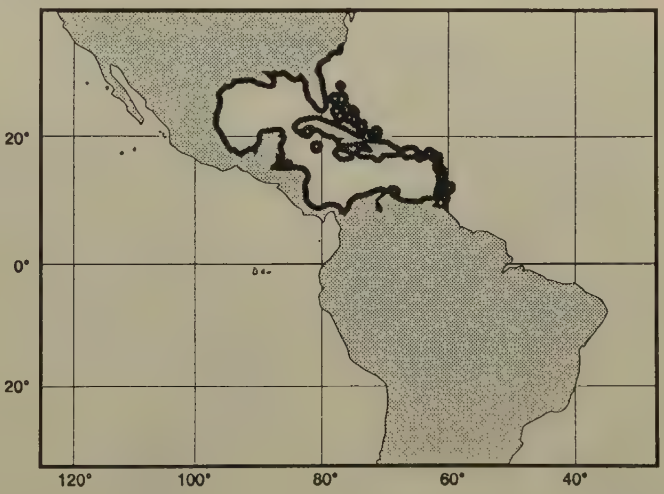


Fig. 320

Colin et al. (1987) observed spawning aggregations of ***E. guttatus*** on the outer reef top in 20 m off the south coast of Puerto Rico. Spawning occurred during the full moon in January and February. Ripe females were recognized by their swollen abdomens and colour pattern of dark spots on a white background; males displayed a darker mottled pattern with an area of dark vertical bars or squares on the body above the anal fin. Females rested on or close to the bottom, while males patrolled around an area that included 1 to 5 females and defended this territory from other males. On two occasions, spawning was initiated by a female swimming about 0.5 m up off the bottom and being joined by a male; gametes were released without any upward rush or rapid movement. In one case, another female joined the pair above the bottom and spawned with them. The ripe eggs are buoyant, clear, nearly spherical (0.97 x 0.96 mm) and usually contain a single oil globule 0.22 mm in diameter; some eggs had multiple smaller oil globules. The perivitelline space was about 0.01 mm in width. Hatching occurred 27 h after fertilization at 26.5oC; after 6 or 7 days mortality greatly increased, and no larva survived through metamorphosis (Colin et al., 1987). Fecundity varies from 90 thousand for a 26 cm (total length) fish to over 3 million eggs in a 45 cm (total length) female (Manooch, 1984).

Size: Maximum total length 76 cm; maximum weight 8.3 kg.

Interest to Fisheries: Although red hind do not grow as large as some other species, it is one of the most important commercial species in the Caribbean in terms of numbers caught and total weight of landings. Red hind landings comprised between 21 and 39% of the total commercial grouper landings from 1985 to 1989 at Bermuda. Caught with hook-and-line, traps, and spear.

Local Names: VENEZUELA: Tofia; WEST INDIES: Cabrilla morja, Strawberry grouper.

Literature: (Additional references not cited above.) Menzel (1960); Randall (1967); Brownell and Rainey (1971); Carpenter and Nelson (1971); Smith (1971); Thompson and Munro (1978); Bauchot et al. (1984); Bullock and Smith (1991).

Remarks: According to Bullock and Smith (1991), commercial fishermen report catching ***Epinephelus guttatus*** and ***E. adscensionis*** from the same reefs in the eastern gulf of Mexico.

Epinephelus haifensis Ben-Tuvia, 1953 Fig. 321; Pl. XVC SERRAN Epin 58

Epinephelus haifensis Ben-Tuvia, 1953:21, fig. 14 (type locality: Mediterranean coast of Israel, off Caesarea; 120 fms.).

Synonyms: ?*Perca gigas* Brünnich, 1768:65 (type locality: Marseille, France). ?*Cerna sicana* Doderlein, 1882:250 (type locality: Palermo, Sicily).

FAO Names: **En** - Haifa grouper; **Fr** - Mérou d'Haifa; **Sp** - Mero de Haifa.

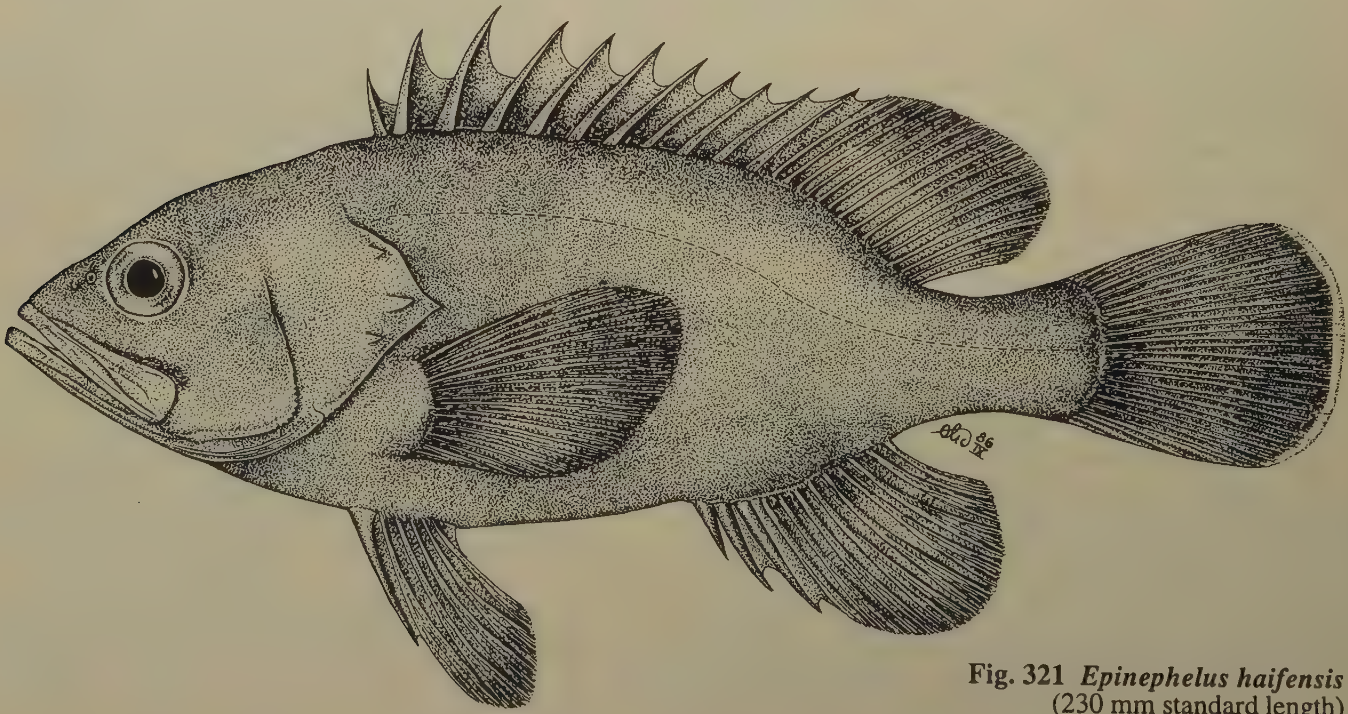


Fig. 321 ***Epinephelus haifensis***
(230 mm standard length)

Diagnostic Features: Body depth contained 2.4 to 2.8 times in standard length (for fish 10 to 39 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area convex; eye diameter greater than interorbital width in fish less than 30 cm standard length, distinctly less than interorbital width in a fish of 39 cm standard length; preopercle subangular, with the serrae at angle enlarged, and 1 to 6 small serrae (usually covered by skin) on lower edge; rear nostrils 2 or 3 times larger than front ones; maxilla naked, not reaching posterior to eye; midlateral part of lower jaw with 2 rows of teeth, the inner teeth distinctly larger than outer teeth. Gill rakers 7 to 10 on upper limb, 13 to 15 on lower limb, total 20 to 25. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, the interspinous membranes deeply incised; anal fin with III spines and 9 rays; pectoral-fin rays 18 to 21, the fin length contained 1.4 to 1.9 times in head length; pelvic fins subequal to pectoral fins, reaching to or beyond anus; caudal fin rounded. Body scales distinctly ctenoid, without auxiliary scales; lateral-line scales 64 to 75; lateral-scale series 104 to 112. Pyloric caeca very numerous, forming a large dendritic mass. **Colour**: Head and body dark brown; soft dorsal, caudal, and anal fins blackish distally (where there are no scales), the basal (scaly) part of these fins not so dark; caudal and pectoral fins with white edge; pelvic fins blackish; prominent black streak on cheek at upper edge of maxilla.

Geographical Distribution: Eastern Mediterranean to southern Angola (14°S). We have examined specimens from the coasts of Israel, Togo, Nigeria, Cameroun, Congo, and Angola (Fig. 322).

Habitat and Biology: Found on bottoms of mud, sand, or rock in depths of 90 to 220 m (Poll, 1954).

Size: According to Poll (1954), ***E. haifensis*** (identified as "***E. gigas***") attains 110 cm total length and a weight of 25 kg.

Interest to Fisheries: Possibly of importance to fisheries in the Mediterranean and along the west coast of Africa, but the catch of ***E. haifensis*** is uncertain because of its confusion with ***E. marginatus***.

Local Names:

Literature: Poll (1954, as "***Epinephelus gigas***") and Heemstra (1991). Poll (1954) confirms their identification as ***E. haifensis***.

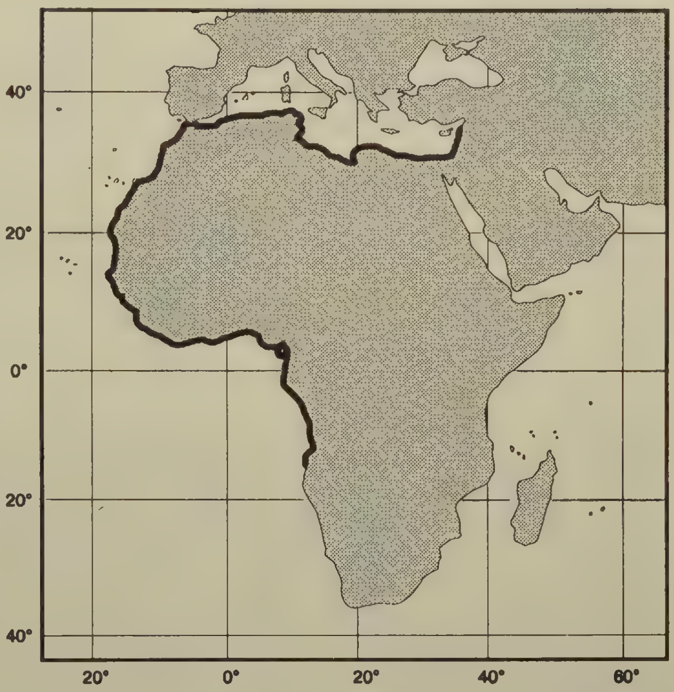


Fig. 322

Remarks: In the literature on Mediterranean and west African groupers (Cadenat, 1935; Tortonese, 1970; Bauchot and Pras, 1980; etc.) ***E. haifensis*** may have been confused with ***E. marginatus*** under the name of "***Epinephelus guaza***" or "***Epinephelus gigas***." Although we have examined only 19 specimens of ***E. haifensis***, they all have 9 anal-fin rays; whereas, 79 of the 80 specimens of ***E. marginatus*** that we have seen have 8 anal-fin rays. Consequently, references to ***E. guaza*** with 8 or 9 anal-fin rays could apply to both species.

The species described as ***Perca gigas*** by Brünnich (1768) may be the same as ***E. haifensis***, but the pectoral-fin count of 16 given by Brünnich is too low, and the colour description ("*corporis ochraceus, obscuro fuscoque nebulosus; caput subtus rubrum ut + pinnae pectorales extrorsum.*" [body yellowish, with indistinct dark blotches; lower part of head and margin of pectoral fins reddish]) is more similar to the colour pattern of ***E. marginatus***. Without a type specimen, ***Perca gigas*** is probably best regarded as a *nomen dubium.*

The stuffed holotype of ***Cerna sicana*** Doderlein from Sicily has only X dorsal-fin spines. Tortonese (1956) redescribed this specimen and concluded that it was not the western Atlantic species ***E. nigritus***, which normally has X dorsal-fin spines. Except for having only X dorsal-fin spines, this specimen fits the description of ***E. haifensis*** given above. ***Cerna sicana*** may represent a rare species with X dorsal-fin spines that is known from only a single specimen, but it seems more likely that this holotype is simply an abnormal specimen of ***E. haifensis***. Since we are reluctant to use ***E. sicana*** as the valid name for a species that normally has XI dorsal-fin spines, we here accept ***Epinephelus haifensis*** as the valid name for this species.

Epinephelus heniochus Fowler, 1904

Fig. 323; Pl. XVD

SERRAN Epin 78

Epinephelus heniochus Fowler, 1904:522, pl. 18 (type locality: Padang, Sumatra [Sumatera]).

Synonyms: *Epinephelus hata* Katayama, 1953:52, figs 1 and 2 (type locality: Nagasaki, Japan).

FAO Names: **En** - Bridled grouper; **Fr** - Mérou bride; **Sp** - Mero embridado.

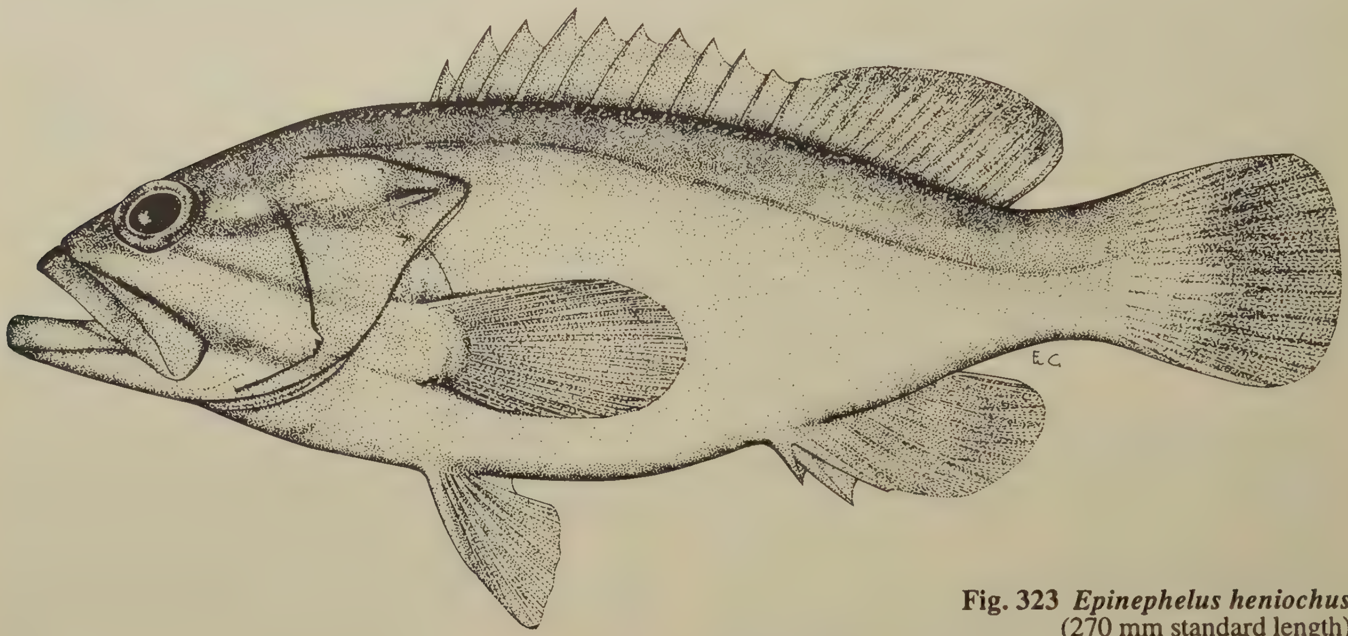


Fig. 323 ***Epinephelus heniochus***
(270 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.2 times in standard length (for fish 10 to 27 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area slightly convex; dorsal head profile distinctly convex; preopercle angular, with 2 to 4 large spines at the angle; upper edge of operculum approximately straight; posterior nostrils about twice as large as anterior nostrils; maxilla usually reaches to or slightly past a vertical at rear edge of eye; lower edge of maxilla with a step-like bend in adults; canines at front of jaws well developed, especially in upper jaw; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 3.0 to 3.8 times in head length and shorter than longest dorsal-fin rays; anal fin with III spines and 8 rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.6 to 1.9 times and pelvic-fin length contained 1.9 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 54 to 60; lateral-scale series 89 to 100. Pyloric caeca 7 or 8. **Colour**: Head and body pale brown dorsally, shading to whitish or pale pink ventrally; some specimens with minute brownish black dots on body and rear part of head; faint dark brown stripe from eye to end of operculum, another darker stripe from lower edge of eye to subopercle and a third from edge of preorbital to interopercle; pectoral fins hyaline greyish yellow; lower part of caudal fin sometimes darker than rest of fin; margin of interspinous dorsal-fin membranes yellow. The fish illustrated by Gloerfelt-Tarp and Kailola (1984) has a narrow dark brown margin along the rear edge of the caudal fin.

Geographical Distribution: Tropical western Pacific; *E. heniochus* is known with certainty from Indonesia, the Philippines, Gulf of Thailand, Viet Nam, northern Australia, and New Britain. Although Katayama's type specimens of *Epinephelus hata* were purchased from the Nagasaki fish market, the absence of other records of *E. heniochus* from Japan indicates that the types of *E. hata* may have been caught south of Japan (Fig. 324).

Habitat and Biology: *E. heniochus* seems to prefer soft (sedimentary) bottom, rather than rocky areas; most specimens have been taken with trawls on mud or silty sand bottom in depths of 40 to 235 m. Nothing has been published on the biology of this species.

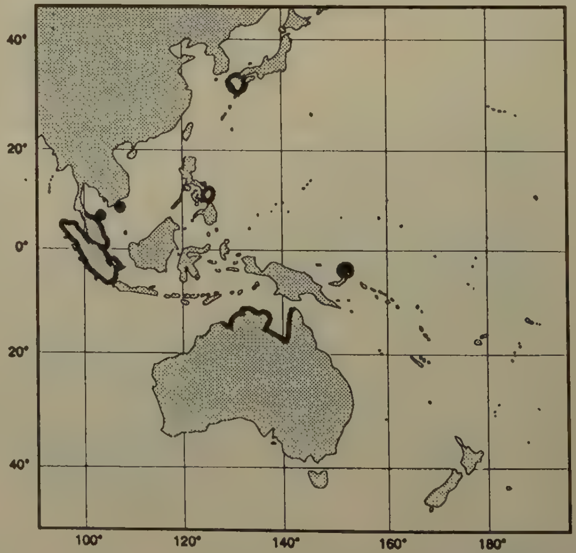


Fig. 324

Size: Attains at least 35 cm standard length (43 cm total length).

Interest to Fisheries: According to Tan et al. (1982), *E. heniochus* is "common but not abundant" in the South China Sea, and it is not a "very popular food fish" (in the markets of Singapore). Caught with trawls and vertical longlines.

Local Names: JAPAN: Hohosujihata.

Literature: Randall and Heemstra (1991).

Remarks: *E. heniochus* is similar to *E. epistictus*. These two species share the following characters: distinctly enlarged serrae at the corner of the preopercle, 14 or 15 dorsal-fin rays, interspinous dorsal-fin membranes distinctly incised, midlateral part of lower jaw with 2 rows of teeth, similar morphometric features, and similarities in colour pattern. *E. epistictus* differs from *E. heniochus* in having more numerous scales (lateral-line scales 57 to 70 and lateral-scale series 105 to 127) and the dark brown or black dots on the body and rear part of head are conspicuous and larger than the exposed part of each scale and extend onto the dorsal and caudal fins; whereas, the dark dots of *E. heniochus* (if they are present) are faint and smaller than the exposed parts of the scales, and the dorsal and caudal fins are usually unspotted.

Epinephelus hexagonatus (Forster, 1801) Fig. 325; Pl. XVE SERRAN Epin 34

Holocentrus hexagonatus Forster in Bloch and Schneider, 1801:323 (type locality: Tahiti).

Synonyms: ***Serranus Parkinsonii*** Valenciennes in Cuv. and Val., 1828:329 (type locality: Tahiti). ***Serranus stellans*** Richardson, 1842:23 (type locality: Melville Island, Torres Strait).

FAO Names: **En** - Starspotted grouper (formerly: White-specked grouper); **Fr** - Mérou mélifère; **Sp** - Mero mielero.

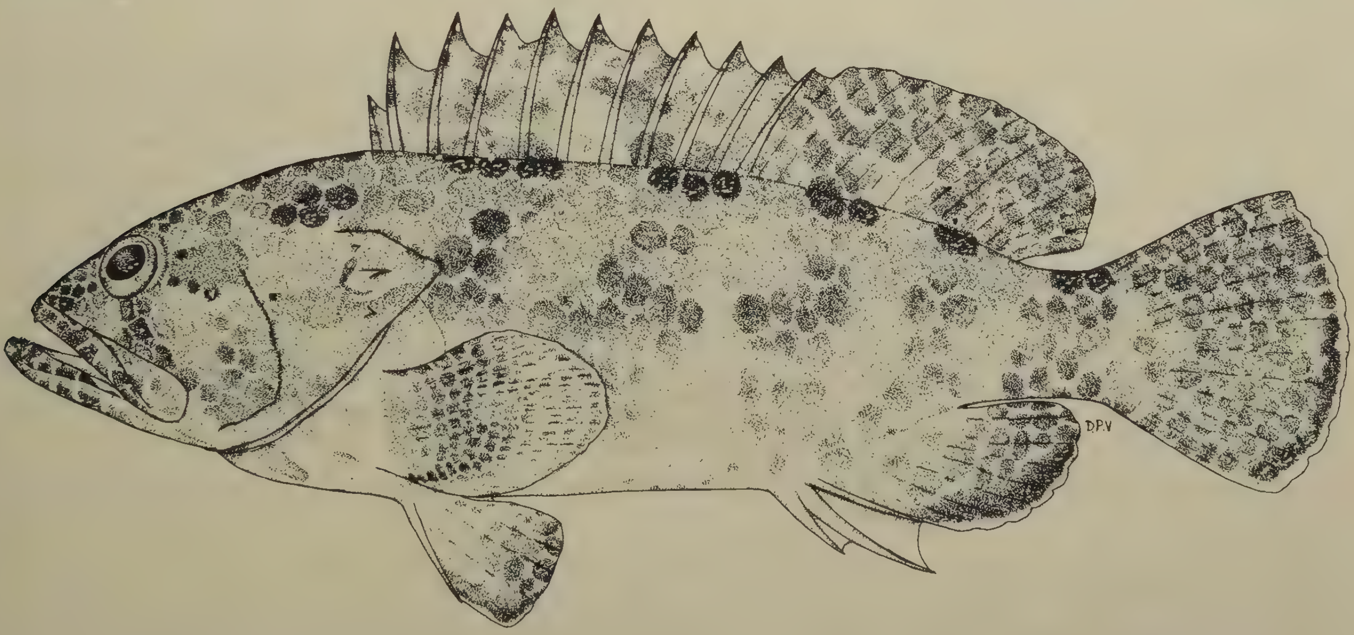


Fig. 325 *Epinephelus hexagonatus*
(152 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.4 times in standard length (for fish 10 to 17 cm standard length). Head length contained 2.5 to 2.6 times in standard length; interorbital area flat, the dorsal head profile convex; preopercle rounded, the ventral serrae slightly enlarged; upper edge of operculum convex; nostrils subequal; maxilla reaches to or past vertical at rear edge of eye; ventral edge of maxilla smoothly curved; midlateral part of lower jaw with 3 to 5 rows of teeth. Gill rakers 7 to 9 on upper limb, 17 to 19 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the fifth to ninth spines subequal (their length contained 2.5 to 2.8 times in head length) and slightly shorter than longest rays, the interspinous membranes incised; anal fin with III spines and 8 rays, the second spine contained 2.1 to 2.5 times in head length, distinctly longer than third spine or depth of peduncle; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 1.9 times in head length; pelvic fins not reaching past anus, their length contained 1.8 to 2.1 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 61 to 70; lateral-scale series 93 to 114. **Colour**: Head and body covered with polygonal (mostly hexagonal) brown spots that tend to merge, leaving only conspicuous triangular white dots at corners of the polygons; spots on belly and ventral part of head more rounded and separated and often reddish brown; 4 or 5 brownish black saddle blotches (formed by groups of darker spots) on dorsal part of body and caudal peduncle, the first 4 extending onto base of dorsal fin; irregular dark bar, formed by darker polygonal spots, on lower part of body below each saddle blotch; dark spots on head progressively smaller anteriorly; large dark brown or olive spot just behind eye, sometimes joined to a horizontally elongate spot of the same colour on opercle; all fins with close-set dark brown or reddish brown spots and white dots, except outer half of pectoral fins with faint dark spots and no white dots; leading edge of pelvic fins and distal margin of anal fin with pale edge and dark brown submarginal band; margin of interspinous dorsal-fin membranes with a blackish brown triangle and short white or pale yellow filament behind tip of each spine. The conspicuous white dots on the body and fins often persist on preserved specimens.

Geographical Distribution: *E. hexagonatus* is one of the most widely distributed groupers, occurring from the western Indian Ocean to Henderson Island in the Pitcairn Group. It is an insular species, and its absence in the Red Sea and Persian Gulf may be due to its avoidance of continental shelf environments. It is known from most of the tropical Indo-Pacific islands; however, the 112 mm standard length specimen from the Chagos Islands that was illustrated by Winterbottom et al. (1989:fig. 135) is *E. spilotoceps*. *E. hexagonatus* occurs at Latham and Zanzibar islands off the coast of Tanzania, but none have been taken on the African coast, except for the specimen recorded by Randall and Heemstra (1991) from the Kenyan coast north of Kilifi Creek. We have examined specimens from the Comoros, Mauritius, Réunion, Japan (Ryukyu and Izu Islands), and most of the islands of the western and central Pacific region (both on and off the Pacific Plate). It is known from islands of the Great Barrier Reef, but no specimens have been collected from the mainland coast of Australia. We know of no verifiable records from Indonesia, the Philippines, Taiwan, or the Hawaiian Islands (Fig. 326).

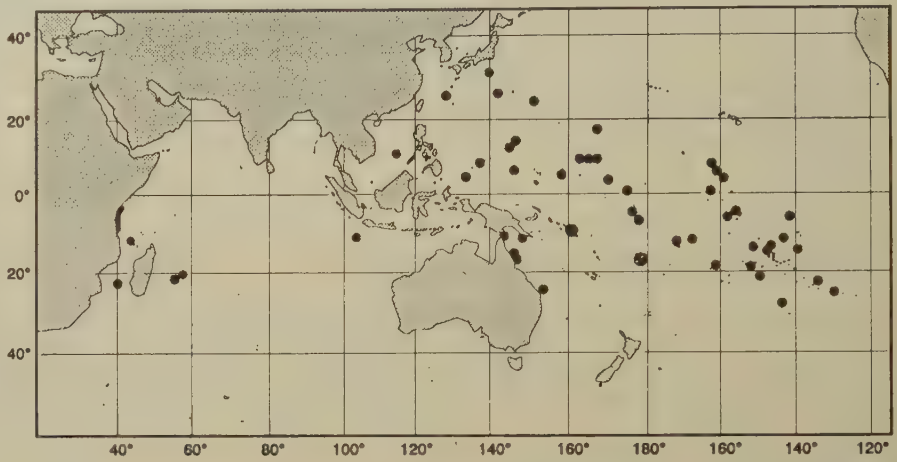


Fig. 326

Habitat and Biology: *E. hexagonatus* is a coral-reef species, which is usually found in shallow outer-reef areas exposed to surge. It feeds mainly on fishes and crustaceans (especially stomatopods and brachyuran crabs).

Size: Maximum total length about 26 cm.

Interest to Fisheries: Probably of some importance as a food fish in artisanal fisheries because of its abundance at most islands. Caught with hook-and-line, traps, spear, and in gill nets.

Local Names: GAMBIER ISLANDS: Ako; JAPAN: Ishigakihata; MARQUESAS: Taaiao, Teeiao; TAHITI: Tarao a'au.

Literature: Randall and Brock (1960); Hiatt and Strasburg (1960); Harmelin-Vivien and Bouchon (1976); Randall and Heemstra (1991).

Remarks: *E. hexagonatus* is one of 9 shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots, with the pale interspaces forming a network on the body. These "reticulated groupers" have been much confused in the literature, and many museum specimens have been misidentified. These other species differ from *E. hexagonatus* as follows:

E. bilobatus has 3 bilobed dark blotches or close-set pairs of dark brown spots on body and base of dorsal fin, no white dots on body, dorsal-fin rays 17 or 18; second and third anal-fin spines subequal, and lateral-line scales 48 to 52.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), no white dots on body, midlateral part of lower jaw with 2 rows of teeth, and lateral-line scales 48 to 52.

E. macrospilos has the lateral-body scales mostly smooth, lateral-line scales 48 to 52, lower gill rakers 14 to 17, no triangular white dots on the body, and pectoral fins dusky with narrow white edge.

E. maculatus has the dorsal-fin membranes not incised between the spines; third or fourth dorsal-fin spine longest (its length contained 2.1 to 2.6 times in head length and usually longer than dorsal-fin rays), no white dots on body, and juveniles have a few large white blotches on body and dorsal fin.

E. melanostigma has a single black blotch at base of last 4 dorsal-fin spines and no white dots on the body, second anal-fin spine subequal to third, its length contained 2.6 to 3.6 times in head length and not more than depth of peduncle.

E. merra has the pectoral fins with small black spots largely confined to the rays, no white dots on body, no black blotches at base of dorsal fin, and 48 to 53 lateral-lines scales.

E. quoyanus has lateral-line scales 48 to 52, lower gill rakers 14 to 16, larger pectoral fins (its length contained 1.2 to 1.7 times in head length), second and third anal-fin spines subequal and not much longer than depth of peduncle, and no triangular white dots on body.

E. spilotoceps has distinct black dots on the snout, no triangular white dots on body, no large olive-brown spot behind eye, shorter second anal-fin spine (its length contained 2.4 to 3.4 times in head length), and a distinct notch in rear edge of preopercle just above the corner.

Epinephelus howlandi (Günther, 1873) Fig. 327; Pl. XVF SERRAN Epin 79

Serranus howlandi Günther, 1873:8, pl. 9, fig. B (type locality: Howland Island, central Pacific Ocean).

Synonyms: *Epinephelus spilotus* Schultz, 1953:332, 352, fig. 55 (type locality: Enewetak Atoll, Marshall Islands). Often misidentified as *E. macrospilos* or *E. corallicola.*

FAO Names: **En** - Blacksaddle grouper; **Fr** - Mérou selle noir; **Sp** - Mero montura negra.

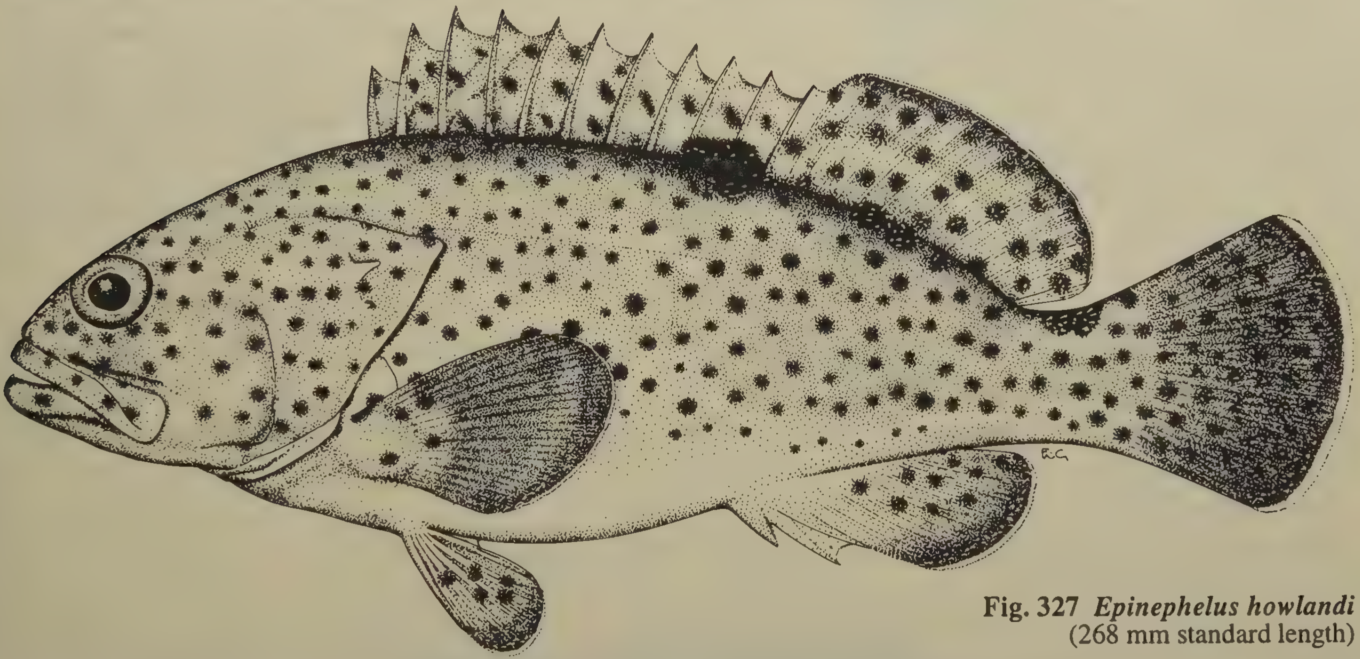


Fig. 327 *Epinephelus howlandi* (268 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.3 times in standard length (for fish 10 to 31 cm standard length). Head length contained 2.2 to 2.5 times in standard length; interorbital area flat, the dorsal head profile convex; preopercle rounded, the serrae at "angle" slightly enlarged; upper edge of operculum almost straight; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb, total 23 to 26; gill raker at angle distinctly longer than adjacent rakers. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, subequal to longest rays and contained 2.7 to 3.6 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays, the second and third spines subequal; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic fins not reaching anus except in small specimens, their length contained 2.0 to 2.4 times in head length; caudal fin rounded. Lateral-body scales usually smooth (a few ctenoid scales may be found in area covered by pectoral fin), with numerous auxiliary scales; lateral-line scales 49 to 52; lateral-scale series 85 to 102. Pseudobranch pocket well developed; pyloric caeca 13. **Colour**: Head and body pale grey or brownish grey, covered with small brownish black spots (centre black, edges diffuse and brownish) separated from adjacent spots by spaces equal to or greater than width of spots; black saddle blotch on body and dorsal fin at base of last 3 spines and a smaller black saddle blotch on caudal peduncle; no dark spots on belly, chest or underside of head; median and pelvic fins with dark spots as on body, the margins of soft dorsal, caudal, and anal fins dusky, with a white line along the edge; pectoral fins dusky with a few dark spots basally.

Geographical Distribution: *E. howlandi* occurs in the tropical western central Pacific from the Ryukyu Islands to New Guinea, the Great Barrier Reef and eastward to Lord Howe Island, New Caledonia, Vanuatu, Caroline Islands, Palau, Marshall and Mariana Islands, Howland Island, and the Samoa Islands (Fig. 328).

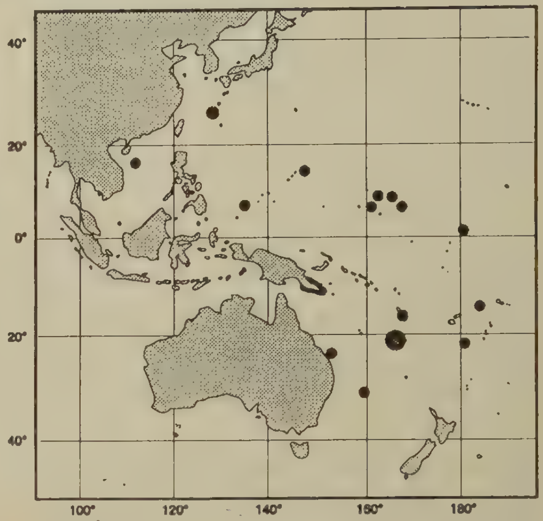


Fig. 328

Habitat and Biology: Usually found in rocky areas or on coral reefs at depths from 1 to 37 m. Nothing has been published on the biology of *E. howlandi*.

Size: Attains at least 44 cm total length (35 cm standard length).

Interest to Fisheries: *E. howlandi* appears to be rare and is thus of little commercial importance.

Local Names: JAPAN: Hiregurohata.

Literature: Randall and Heemstra (1991).

Remarks: Boulenger (1895) synonymized *Serranus howlandi* Günther and *S. macrospilos* Bleeker with *E. corallicola* (Valenciennes), and these three species have been confused ever since. Katayama (1960, 1988) and Shirai (1986) misidentified *E. howlandi* as *E. corallicola*. Hoese (1976) was the first author to recognize *E. howlandi* as a valid species and distinguish it from *E. corallicola*. Schultz (1953) shifted *E. howlandi* to the synonymy of *E. macrospilos*, and Randall (1987), Masuda and Allen, (1987) and Myers (1989) also misidentified it as *E. macrospilos*. The colour pattern of adult *E. corallicola* is similar to that of *E. howlandi*, but the latter lacks dark spots on the belly, chest, underside of the head, and on the dorsal part of the eye (these areas spotted in *E. corallicola*); and *E. howlandi* has a white line along the edge of the anal and caudal fins, which is absent in *E. corallicola*. Other characters by which *E. corallicola* differs from *E. howlandi* are the ctenoid lateral-body scales, 53 to 63 lateral-line scales, posterior nostrils vertically elongate in adults, absence of a pseudobranch pocket, and the gill raker at the angle of the first gill arch subequal in length to adjacent rakers. *E. macrospilos* differs from *E. howlandi* in lacking a black blotch on body at base of last 3 dorsal-fin spines, and in having a submarginal series of dark spots paralleling rear edge of caudal fin, usually fewer gill rakers (total 21 to 25), pectoral-fin rays 17 to 20 (usually 19), and a strongly projecting lower jaw.

Epinephelus indistinctus Randall and Heemstra, 1991

Fig. 329

SERRAN Epin 80

Epinephelus indistinctus Randall and Heemstra, 1991:171, fig. 84 (type locality: Indian Ocean off Somalia, 09°3'N, 50°59'E).

Synonyms: None.

FAO Names: **En** - Somali grouper; **Fr** - Mérou somali; **Sp** - Mero somalí.

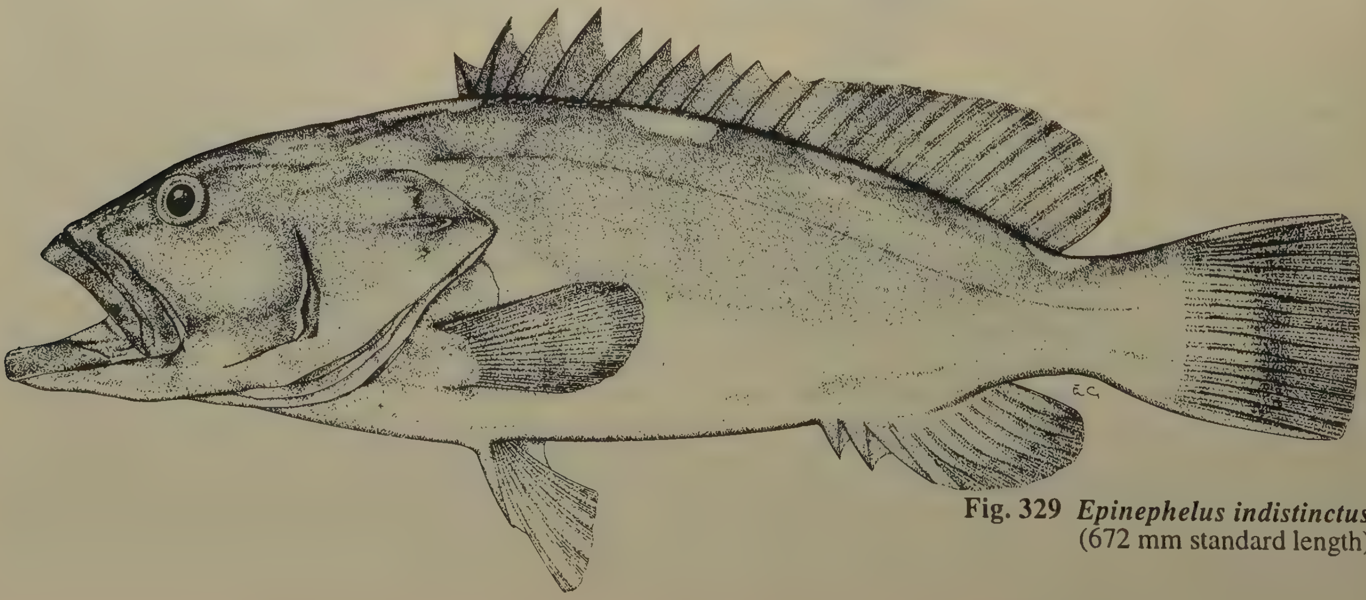


Fig. 329 ***Epinephelus indistinctus***
(672 mm standard length)

Diagnostic Features: Body depth contained 3.2 times in standard length (1 specimen, 672 mm standard length). Head length contained 2.3 times in standard length; interorbital area convex, the dorsal head profile slightly convex; preopercle angular, with a shallow indentation just above the rounded angle, the serrae not noticeably enlarged at the angle; upper edge of operculum almost straight; nostrils subequal; maxilla probably reaches vertical at rear edge of eye (holotype preserved with mouth wide open); midlateral part of lower jaw with 2 rows of subequal small teeth; small canines at front of jaws. Gill rakers 9 on upper limb, 14 on lower limb, the longest raker about 2/3 length of longest gill filament; small bony platelets on gill arches. Dorsal fin with XI spines and 14 rays, the fourth spine longest, its length contained 4.2 times in head length and shorter than longest dorsal-fin rays, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18; pectoral-fin length contained 2.4 times in head length; pelvic-fin length contained 2.7 times in head length; caudal-fin rear margin slightly convex. Lateral-body scales smooth (except for area covered by pectoral fins), with numerous auxiliary scales; lateral-line scales 64; lateral-scales series 114. Pyloric caeca more than 50. **Colour** in alcohol: Head, body, and median fins dark greyish brown, the exposed part of dorsolateral-body scales darker, thus giving a faint finely dotted pattern; 4 faint pale blotches on body at base of dorsal fin, the first at origin of fin and extending anterior to it, the last at base of last 3 or 4 rays and extending onto top of front half of peduncle.

Geographical Distribution: Known only from Indian Ocean off Somalia (Fig. 330).

Habitat and Biology: The holotype was caught with a trawl at a depth of 70 to 80 m.

Size: Attains at least 67 cm standard length (80 cm total length).

Interest to Fisheries: Unknown.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: *E. indistinctus* is known only from the holotype collected of Somalia. It has the same shape, fin-ray and scale counts, and nondescript colour pattern (on large adults) as *E. bruneus* of the western Pacific, but *E. bruneus* has longer teeth, 16 to 18 lower gill rakers, no auxiliary scales on body, and enlarged serrae at preopercle angle.

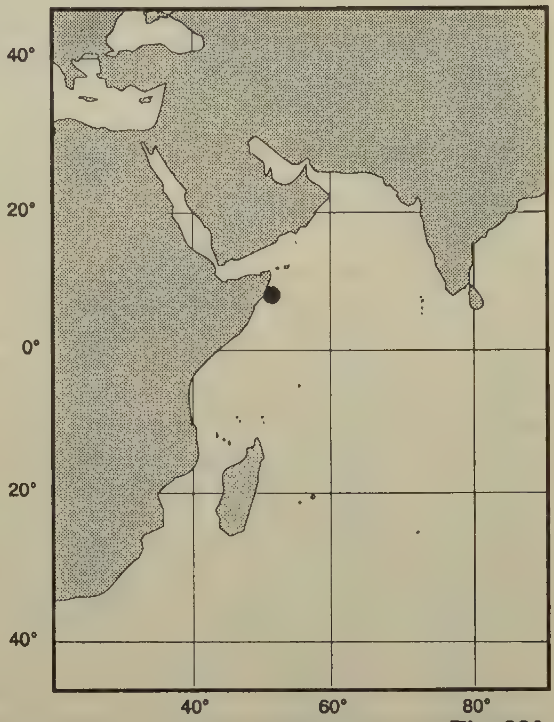


Fig. 330

Epinephelus irroratus (Forster, 1801)   Fig. 331; Pl. XVIA   SERRAN Epin 81

Percam irroratum Forster in Bloch and Schneider, 1801:333 (type locality: Santa Christina Island [= Tahuata] Marquesas Islands).

Synonyms: *Perca irrorata* Forster, 1844:222 (type locality: Santa Christina Island). *Serranus spiniger* Günther, 1859:146 (type locality: unknown). *Epinephelus albopunctulatus* Boulenger, 1895:234, pl. 9 (type ocality: Nuku Hiva, Marquesas Islands).

FAO Names: **En** - Marquesan grouper; **Fr** - Mérou Marquises; **Sp** - Mero marquesano.

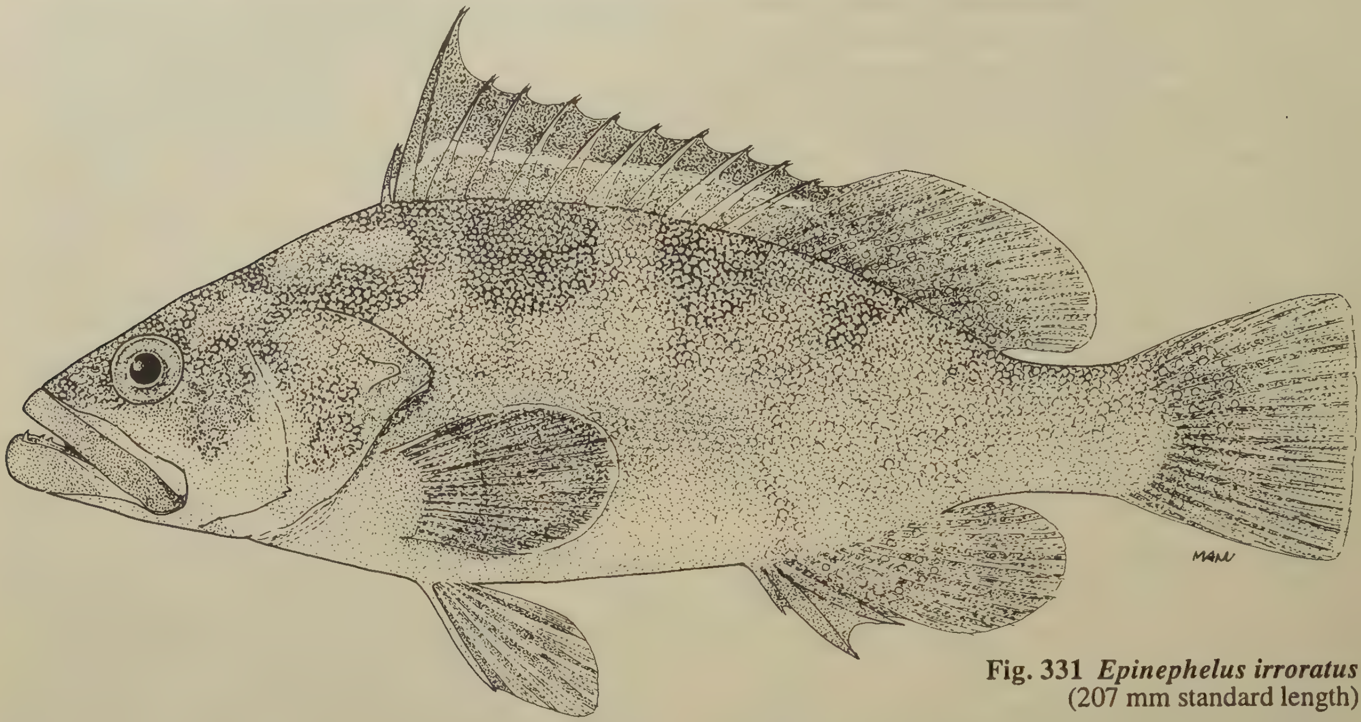


Fig. 331 *Epinephelus irroratus*
(207 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.3 times in standard length (for fish 14 to 28 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area and dorsal head profile slightly convex; preopercle corner rounded and slightly indented, the lower serrae scarcely enlarged; upper edge of operculum almost straight; posterior nostrils about twice the size of anterior nostrils; maxilla reaching to or just past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 6 to 8 on upper limb, 13 to 16 on lower limb. Dorsal fin with XI spines and 16 rays, the second spine greatly elongated in adults, more than twice length of third spine, the interspinous membranes not or only slightly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.6 to 1.9 times in head length; pelvic fins not reaching past anus, their length contained 1.8 to 2.0 times in head length; caudal fin truncate to slightly rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 70 to 75; lateral-scale series 117 to 136. **Colour:** Reddish brown with white dot on each scale (dots may not persist in preservative); maxillary streak dark reddish brown; spinous dorsal fin with prominent dark red margin; white line along rear edges of median and pectoral fins.

Geographical Distribution: *E. irroratus* is known only from the Marquesas Islands and 1 specimen from Minami Tori Shima (Marcus Island) (Fig. 332); the latter record may be erroneous (see Remarks below).

Habitat and Biology: Abundant in shallow water around fringing coral reefs. Nothing has been published on the biology of this species.

Size: Attains at least 34 cm total length.

Interest to Fisheries: *E. irroratus* is of considerable interest to the artisanal fishery of the Marquesas Islands. Caught with hook-and-line, spear, and traps.

Local Names: MARQUESAS: Kopau.

Literature: Bagnis et al. (1972); Zama (1978); Randall and Heemstra (1991).

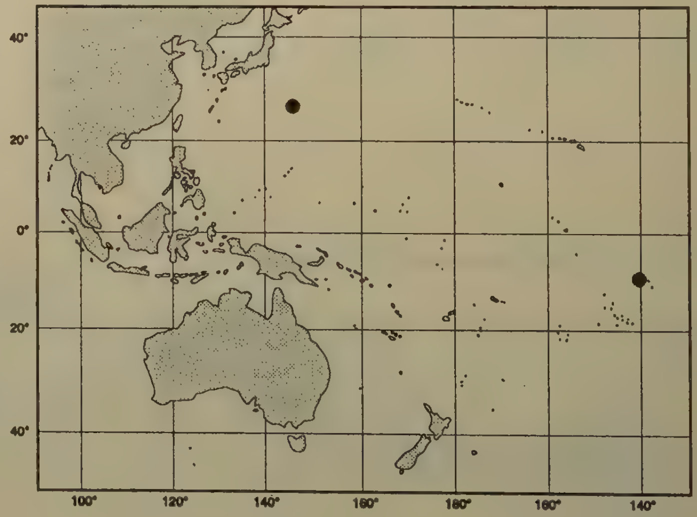


Fig. 332

Remarks: Except for the single specimen reported from Minami Tori Shima Island by Bryan and Herre (1903), *E. irroratus* is known only from the Marquesas Islands where it is a relatively common inshore species. In view of the vast distance (about 7 500 km) between these two localities, the absence of other records outside the Marquesas, and the failure to find the species during two weeks of fish collecting by one of us (J.E.R.) at Minami Tori Shima; it seems likely that this report of *E. irroratus* may be based on a locality error.

Epinephelus itajara (Lichtenstein, 1822)

Fig. 333; Pl. XVIB

SERRAN Epin 17

Serranus itajara Lichtenstein, 1822:278 (type locality: Brazil).

Synonyms: ?*Serranus Mentzelii* Valenciennes, 1828:291 (type locality: Brazil). ?*Serranus galeus* Müller and Troschel, 1848:621 (type locality: Guyana). *Serranus guasa* Poey, 1861:141, 354, pl. 13, fig. 8 (type locality: Cuba). *Serranus quinquefasciatus* Bocourt, 1868:223 (type locality: Pacific coast of Guatemala). ?*Promicrops esonue* Ehrenbaum, 1914:293; 1915:54, fig. (type locality: Cameroun). ?*Promicrops ditobo* Roux and Collignon, 1954:473 (type locality: French Equatorial Africa: Kouilou estuary).

FAO Names: **En** - Jewfish (formerly: Giant grouper); **Fr** - Mérou géant; **Sp** - Mero guasa.

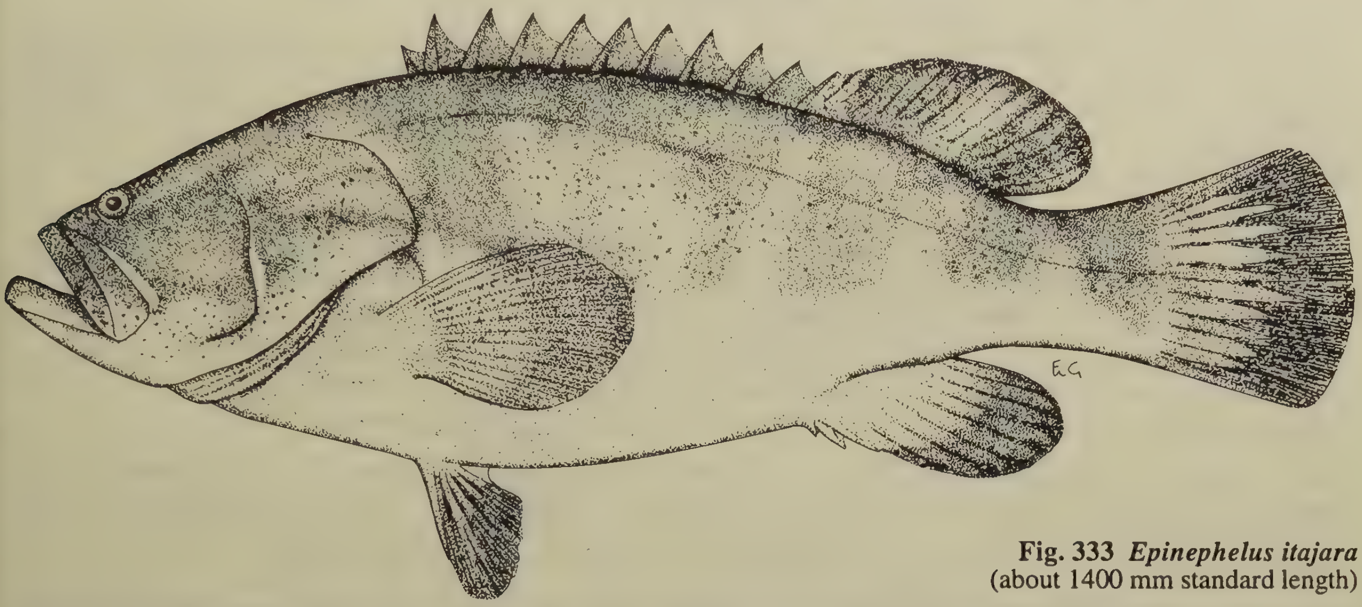


Fig. 333 ***Epinephelus itajara***
(about 1400 mm standard length)

Diagnostic Features: Body robust, elongate, the greatest width more than half of body depth, which is distinctly less than head length (in fish 15 to 160 cm); body depth contained 2.7 to 3.4 times in standard length. Head length contained 2.3 to 2.9 times in standard length; head extremely broad; interorbital flat, the width equals eye diameter in fish 10 to 15 cm standard length, distinctly greater than eye diameter in fish 18 to 25 cm standard length, and 1.5 to 3.4 times greater than eye diameter in fish 30 to 160 cm standard length; eye diameter contained 5 to 8 times in head length for fish 10 to 30 cm standard length and 8 to 13 times in head length for fish 35 to 160 cm standard length; preopercle rounded, finely serrate; nostrils round, subequal; maxilla scaly, reaching well past eye; midlateral part of lower jaw with 3 to 5 rows of subequal teeth; no canines at front of jaws. Gill rakers 8 or 9 on upper limb and 13 to 15 on lower limb, total 21 to 24; gill arches covered with small bony plates. Dorsal fin with XI spines and 15 or 16 rays, the spines short, 3rd to 11th subequal and shorter than the first ray, the membranes distinctly indented between the spines; anal fin with III spines and 8 rays; pectoral-fin rays 18 or 19; caudal fin rounded. Body scales strongly ctenoid; lateral-line scales 61 to 64, each with 4 to 6 radiating ridges; lateral-scale series 89 to 112. **Colour**: Generally brownish yellow, grey, or greenish; head, dorsal part of body, and fins with small black spots, becoming smaller with growth. Fish less than about 1 m show 3 or 4 faint, irregular, subvertical dark bars posteriorly on body; and another covering rear half of caudal peduncle; large adults darker and more uniformly coloured than juveniles.

Geographical Distribution: Tropical and subtropical waters of the Atlantic and eastern Pacific oceans. In the western Atlantic, it ranges from Florida to southern Brazil, and is caught widely in the Gulf of Mexico and most of the Caribbean. In the eastern Atlantic, *E. itajara* is reported (as *Epinephelus esonue*) by Séret (1981) and Smith (1981) from Senegal to the Congo; according to Brito (1991) it is rare in the Canary Islands. In the eastern Pacific, it occurs from the Gulf of California to Peru (Fig. 334).

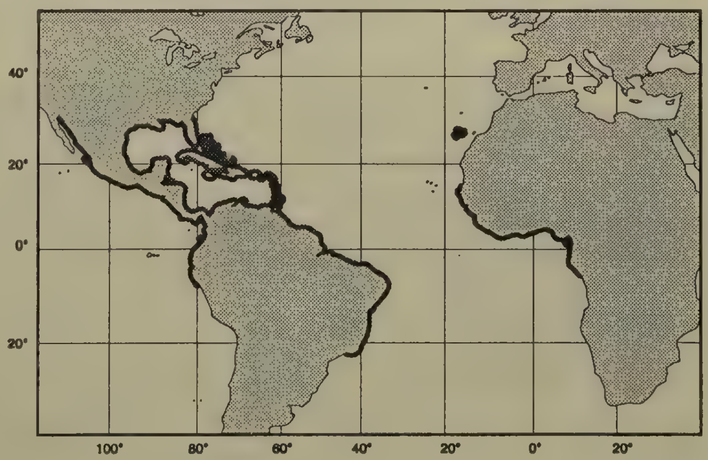


Fig. 334

Habitat and Biology: This giant grouper is often found in shallow water; juveniles are common in mangrove swamps and both juveniles and adults occur in bays and harbours. Large adults are also encountered offshore on wrecks and in areas of high relief; they appear to occupy limited home ranges with little inter-reef movement, and the same individuals were seen at specific reef sites for more than a year (G.B. Smith, 1976).

Schroeder (1924) found that spawning occurred in July and August in the vicinity of Key West, Florida and the greater numbers of large adults captured at this time indicated that the local fishermen were probably exploiting spawning aggregations of this species. G.B. Smith (1976) observed what may have been a spawning aggregation of 20 to 30 large adults (45 to 200 kg) during a dive on a wreck in 36 m off the west coast of Florida in June 1971.

Bullock and Smith (1991) estimated batch fecundity for two females of 132 and 140 cm standard length at 37 to 40 million and 55 to 58 million oocytes, respectively.

Bullock et al. (1992) studied age, growth and reproduction of jewfish from the eastern Gulf of Mexico. Growth averaged >100 mm/year until the age of 6 years, when sexual maturity is attained at a size of 110 to 115 cm total length for males and 120 to 135 cm for females; growth then declined to about 30 mm/year at age 15 (182 to 191 cm total length), and to <10 mm/year after age 25. Age data from 382 fish were used to calculate the von Bertalanffy growth equation: total length (mm) = $2006 (1-e^{(1-0.126(age+0.49))})$.

The oldest fish in their sample was 37 years and measured 197 cm total length. The peak spawning activity occurred during July to September. Contrary to reports for other groupers, Bullock et al. (1992) found that male jewfish are mature at a slightly smaller size and younger age than females, and they found no conclusive evidence for protogyny in this species.

Adults and juveniles feed heavily on crustaceans (shrimps, crabs, and lobsters), and in the Caribbean, jewfish are an important predator of lobsters. *E. itajara* take octopus, fishes (including stingrays, ariid catfishes, spadefish, parrotfish, diodontids and ostaciids), and young sea turtles.

Size: *E. itajara* and *E. lanceolatus* of the Indo-Pacific region are the two largest species of grouper. The maximum size for jewfish is about 250 cm total length and at least 320 kg. The IGFA all-tackle record (as of 1991) is 308 kg. Bullock et al. (1992) gave the following weight/length formula for 66 jewfish: $W = 1.31 \times 10^{-8} L^{3.036}$, where W is whole weight (kg) and L (total length) in millimetres.

Interest to Fisheries: Jewfish are of minor importance in commercial fisheries off the west coast of Florida, were landings for 1988 totalled 61 700 kg. They are easily approached and speared by divers, hence they are scarce in areas accessible to divers. Caught with hook-and-line, occasionally in traps and trawls. Because of their slow growth, longevity, and vulnerability during spawning aggregations, jewfish have recently been designated as protected species in the US Exclusive Economic Zone.

Local Names: BRAZIL: Mero; COLOMBIA: Mero guasa; MEXICO: Cherna; PERU: Cherne; USA: Jewfish; VENEZUELA: Guasa.

Literature: Randall (1967); Smith (1971); Thomson et al. (1979); Bullock and Smith (1991); Heemstra (1991); Bullock et al. (1992).

Remarks: *E. itajara* and *E. lanceolatus* of the Indo-West Pacific region have usually been recognized in the genus *Promicrops*, but we agree with Smith's (1971) decision to include these two species in *Epinephelus*. These two species differ from other species of the genus by having the tubes of the lateral-line scales with 4 to 6 radiating branches. Except for large adults of *E. malabaricus* and *E. coioides* (which have a few anterior lateral-line scales with branched tubules), the lateral-line scales of other *Epinephelus* have unbranched tubes.

Although we doubt that *E. itajara* of the eastern and western Atlantic and the eastern Pacific share a common gene pool, we are unable to find any significant differences in the published data or the specimens that we have examined from these three areas. If there is any species of American grouper that occurs on both sides of the Central American Isthmus, it would be *E. itajara*. It seems feasible that juveniles, with their predilection for estuarine and mangrove habitats, could easily traverse the Isthmus via the Panama Canal. Johnson and Keener (1984) illustrated the second dorsal- and pelvic-fin spines of the larvae.

Epinephelus labriformis (Jenyns, 1843) Fig. 335; Pl. XVIC SERRAN Epin 63

Serranus labriformis Jenyns, 1843:8, pl. 3 (type locality: Galapagos Islands).

Synonyms: *Epinephelus sellicauda* Gill, 1863:250 (type locality: Cape San Lucas, Baja California). *Epinephelus ordinatus* Cope, 1871:466 (type locality: Panama).

FAO Names: **En** - Starry grouper; **Fr** - Mérou étoile; **Sp** - Cabrilla piedrera.

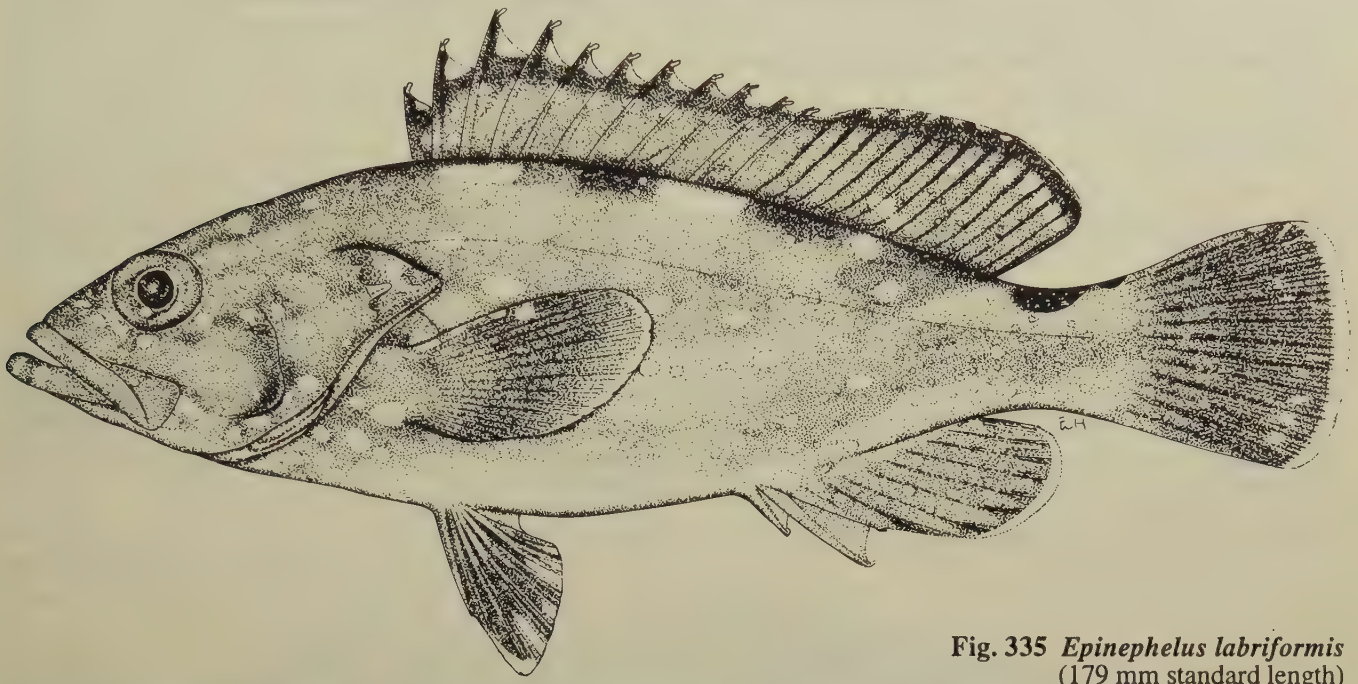


Fig. 335 *Epinephelus labriformis*
(179 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.7 to 3.1 times in standard length (for fish 10 to 33 cm standard length). Head length contained 2.2 to 2.5 times in standard length; interorbital area flat; preopercle rounded, finely serrate, the ventral serrae slightly enlarged; subopercle and interopercle smooth; upper edge of operculum slightly convex; nostrils subequal. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb, 23 to 26 total. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest (longer than the longest dorsal-fin ray) and the interspinous membranes moderately incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 or 19; pelvic fins much shorter than pectoral fins, their origin below or behind pectoral-fin base; caudal fin rounded. Lateral-body scales ctenoid, with a few auxiliary scales; lateral-line scales 48 to 51; lateral-scale series 84 to 100. **Colour**: Generally olive-green to reddish brown with scattered irregular white spots and blotches; white triangle at margin of interspinous dorsal-fin membranes and a bright white tag at tip of each spine; juveniles with black spots on top of head and median fins reddish distally with white edge; small black saddle on peduncle; inside of mouth red.

Geographical Distribution: Eastern Pacific from Gulf of California to Peru, including the offshore islands of Cocos, Revillagigedo, and Galapagos (Fig. 336).

Habitat and Biology: A common shallow-water species of rocky shores, *E. labriformis* is a secretive predator that feeds on small fishes during the day and mainly on crustaceans at night. Although the species is most abundant near shore, adults also occur to depths of at least 30 m.

Size: Maximum total length about 50 cm.

Interest to Fisheries: *E. labriformis* is of some commercial importance in local fisheries. Caught with hook-and-line and in traps.

Local Names: MEXICO: Cabrilla piedrera, Cabrilla pinta; USA: Flag cabrilla.

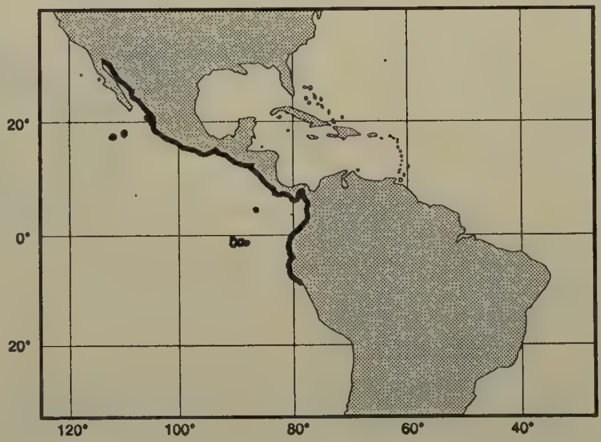


Fig. 336

Literature: Hobson (1968); Smith (1971); Thomson et al. (1979).

Remarks: Lopez Lemus (1988) reckoned that his electrophoretic isozyme data show that *E. labriformis* is more closely related to *Cephalopholis panamensis* than it is to either *E. analogus* or *E. acanthistius*. But his biochemical evidence for this relationship is very tenuous, namely that *C. panamensis* and *E. labriformis* have two enzyme alleles in common that are not shared with *E. analogus*, while *E. labriformis* and *E. analogus* share only one allele that is not also seen in *C. panamensis*. Since this supposed close relationship of *C. panamensis* and *E. labriformis* is indicated by only a single allele, and, in view of the fact that Lopez Lemus has done no comparisons with the enzymes of outgroups in order to infer the polarity of this single allele, his evidence for a sister group relationship between these two species is unconvincing. And we have recently discovered additional morphological differences between *C. panamensis* and *E. labriformis* (e.g., in the shape of the maxilla and presence or absence of trisegmental pterygiophores in the dorsal and anal fins), which indicate that these two species are not congeneric.

Epinephelus lanceolatus (Bloch, 1790)

Fig. 337; Pl. XVID

SERRAN Epin 83

Holocentrus lanceolatus Bloch, 1790:92, pl. 242, fig. 1 (type locality: East Indies).

Synonyms: *Serranus geographicus* Valenciennes in Cuv. and Val., 1828:322 (type locality: Java). *Serranus abdominalis* Peters, 1855b:237 (type locality: Mozambique coast at 15°S). *Batrachus gigas* Günther, 1869:131 (type locality: Seychelles). *Oligorus terrae-reginae* Ramsay, 1880:93, fig. (type locality: Queensland). *Oligorus Goliath* De Vis, 1883:318 (type locality: Moreton Bay, Queensland, Australia). *Serranus phaeostigmaeus* Fowler, 1907:255, fig. 2 (type locality: Hawaiian Islands). *Stereolepoides thompsoni* Fowler, 1923:382 (type locality: Honolulu). *Promicrops lanceolatus*.

FAO Names: **En** - Giant grouper; **Fr** - Mérou lancéólé; **Sp** - Mero lanceolado.

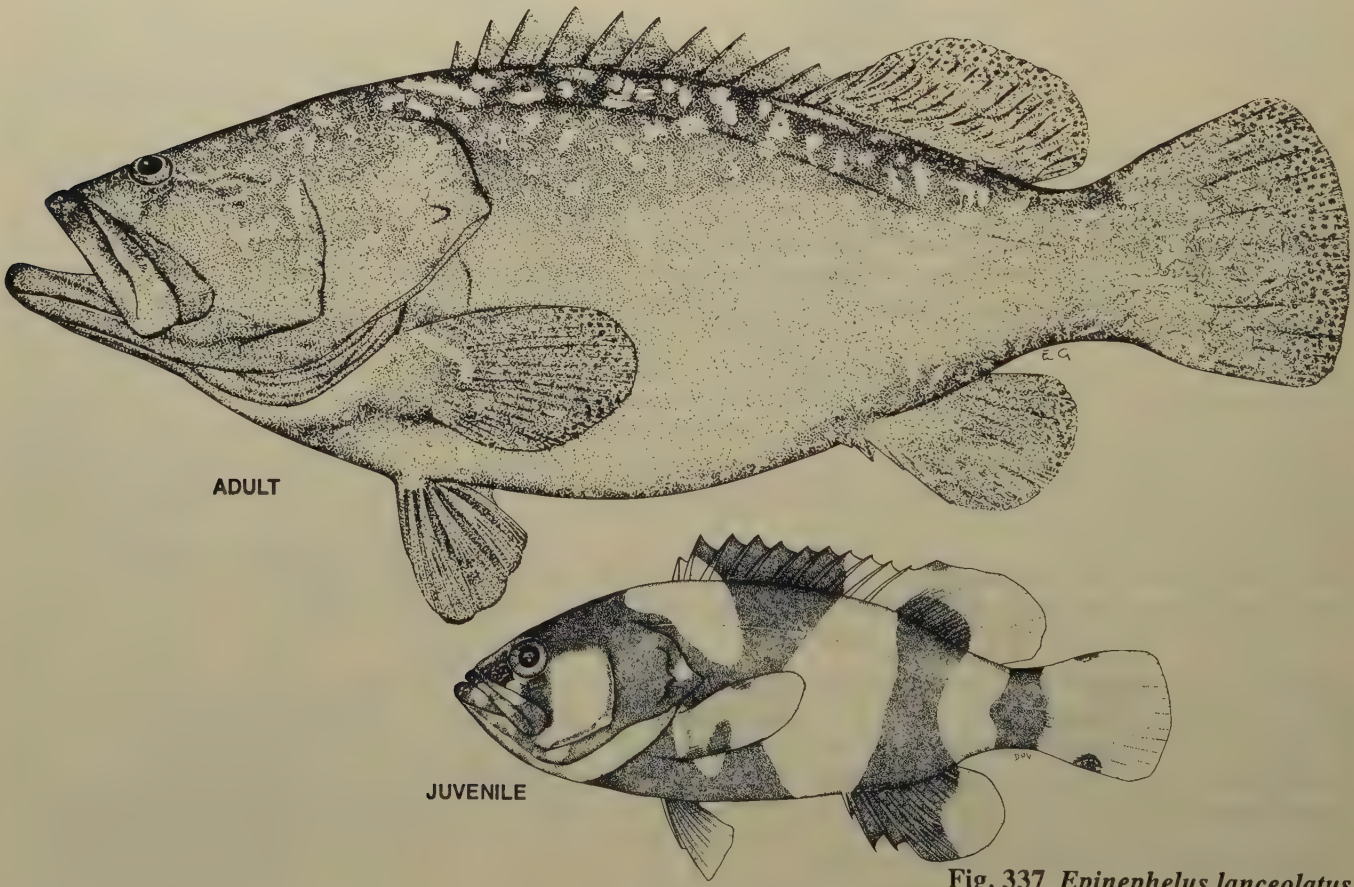


Fig. 337 ***Epinephelus lanceolatus***
(adult 1450 mm standard length, juvenile 30 mm standard length)

Diagnostic Features: Body robust, the depth contained 2.4 to 3.4 times in standard length (for fish 12 to 179 cm standard length), the body width contained 1.5 to 1.75 times in the depth. Head length contained 2.2 to 2.7 times in standard length; interorbital width contained 3.3 (for fish 177 cm standard length) to 6.2 (for fish 12 cm standard length) times in head length; interorbital area flat to slightly convex, the dorsal head profile convex; preopercle subangular, finely serrate, the corner rounded; upper edge of operculum convex; eye diameter contained 5.8 to 14 times in head length; nostrils subequal; maxilla reaching past vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth (specimens of 20 to 25 cm standard length) increasing to 15 to 16 rows in a fish of 177 cm standard length; canine teeth at front of jaws small or absent. Gill rakers of juveniles 8 to 10 on upper limb, 14 to 17 on lower limb; rudiments in adults are difficult to distinguish from the bony platelets covering the gill arch. Dorsal fin with XI spines and 14 to 16 rays, the 3rd to 11th spines subequal, their length contained 3.1 to 5.7 in head length and much shorter than longest rays in adults; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.8 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.1 to 2.6 times in head length; caudal fin rounded. Lateral-body scales smooth, with auxiliary scales; lateral-line scales 54 to 62, the anterior scales with branched tubules (except small juveniles); lateral-scale series 95 to 105. **Colour**: Small juveniles (12 cm standard length) yellow, with irregular broad black bars on body, the first from spinous dorsal fin to belly and chest and extending onto head, the second from base of soft dorsal fin to anal fin and the last at base of caudal fin; small adults (20 to 50 cm standard length) with irregular white or yellow spots on the black areas and fins with irregular black spots; adults (80 to 150 cm standard length) dark brown with faint mottling, the fins with numerous small black spots; large adults (160 to 230 cm standard length) dark brown, the fins darker.

Geographical Distribution: ***E. lanceolatus*** is the most widely distributed grouper in the world; it occurs throughout the Indo-Pacific region from the Red Sea to Algoa Bay, South Africa and eastward to the Hawaiian and Pitcairn Islands. In the western Pacific, ***E. lanceolatus*** ranges northward to southern Japan and southward to Australia (from northern Western Australia to northern New South Wales, and Kailola and Jones (1981) reported a 212 cm total length specimen from South Australia). It is known from oceanic islands as well as continental localities. Its absence in the Persian Gulf is puzzling (Fig. 338).

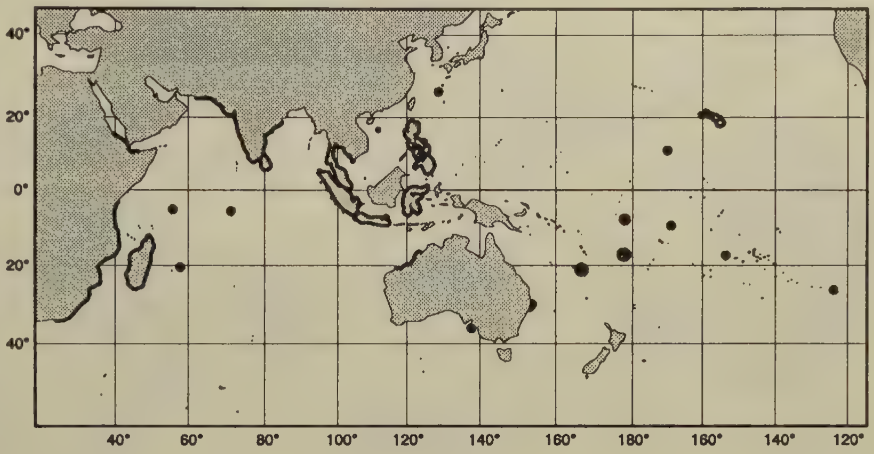


Fig. 338

Habitat and Biology: ***E. lanceolatus*** has been caught at depths of 100 m, but it is more often found in shallow water. Specimens more than a metre long have been caught from shore and in harbours. It is commonly seen in caves on coral reefs and around wrecks; and adults as well as juveniles are found in estuaries. A favourite food on coral reefs and in rocky areas is spiny lobsters. A 177 cm standard length fish, caught from shore at Maui, Hawaiian Islands, contained 2 spiny lobsters and several large crabs. It is also known to eat a variety of fishes, including small sharks and batoids and juvenile sea turtles; in South African estuaries, the main prey item is the mud crab (*Scylla serrata*).

Size: ***E. lanceolatus*** is one of the two largest species of groupers in the world (the other is ***E. itajara*** of the Atlantic and eastern Pacific oceans). Schultz (1966) reported a 231 cm total length, 214 kg specimen from Bikini Atoll. Grant (1982) mentioned a specimen of 288 kg from Queensland. According to Fourmanoir and Laboute (1976), ***E. lanceolatus*** can attain 400 kg.

Interest to Fisheries: ***E. lanceolatus*** is not common enough to be of commercial importance, but it is often the target of spearfishermen because of its size. Caught with hook-and-line and spear.

Local Names: AUSTRALIA: Groper; JAPAN: Tamakai; NEW CALEDONIA: Loche géante, Carite; SOUTH AFRICA: Brindle bass.

Literature: Van der Elst (1981); Witzell (1981); Grant (1982); Randall and Heemstra (1991).

Remarks: ***E. lanceolatus*** and ***E. itajara*** were often assigned to the genus ***Promicrops*** Poey; but C.L. Smith (1971) demoted ***Promicrops*** to a subgenus of ***Epinephelus***, and we agree with this action. These two species are closely related; both grow to enormous size and have a similar body shape, small eye, wide interorbital area, numerous platelets on the gill arches, short dorsal-fin spines, similar fin counts, and anterior lateral-line scales with branched tubules. ***E. itajara*** differs from ***E. lanceolatus*** in having ctenoid scales on the sides of the body, and small black spots on the head and dorsal part of the body.

Epinephelus latifasciatus (Temminck and Schlegel, 1842)

Fig. 339; Pl. XVIE,F

SERRAN Epin 35

Serranus latifasciatus Temminck and Schlegel, 1842:6 (Nagasaki, Japan).

Synonyms: *Serranus grammicus* Day, 1867:700 (type locality: vicinity of Madras, India); Day, 1875:23, pl. 5, fig. 4. *Priacanthichthys maderaspatensis* Day, 1868:193, fig. (type locality: Madras).

FAO Names: **En** - Striped grouper; **Fr** - Mérou à bandes; **Sp** - Mero abanderado.

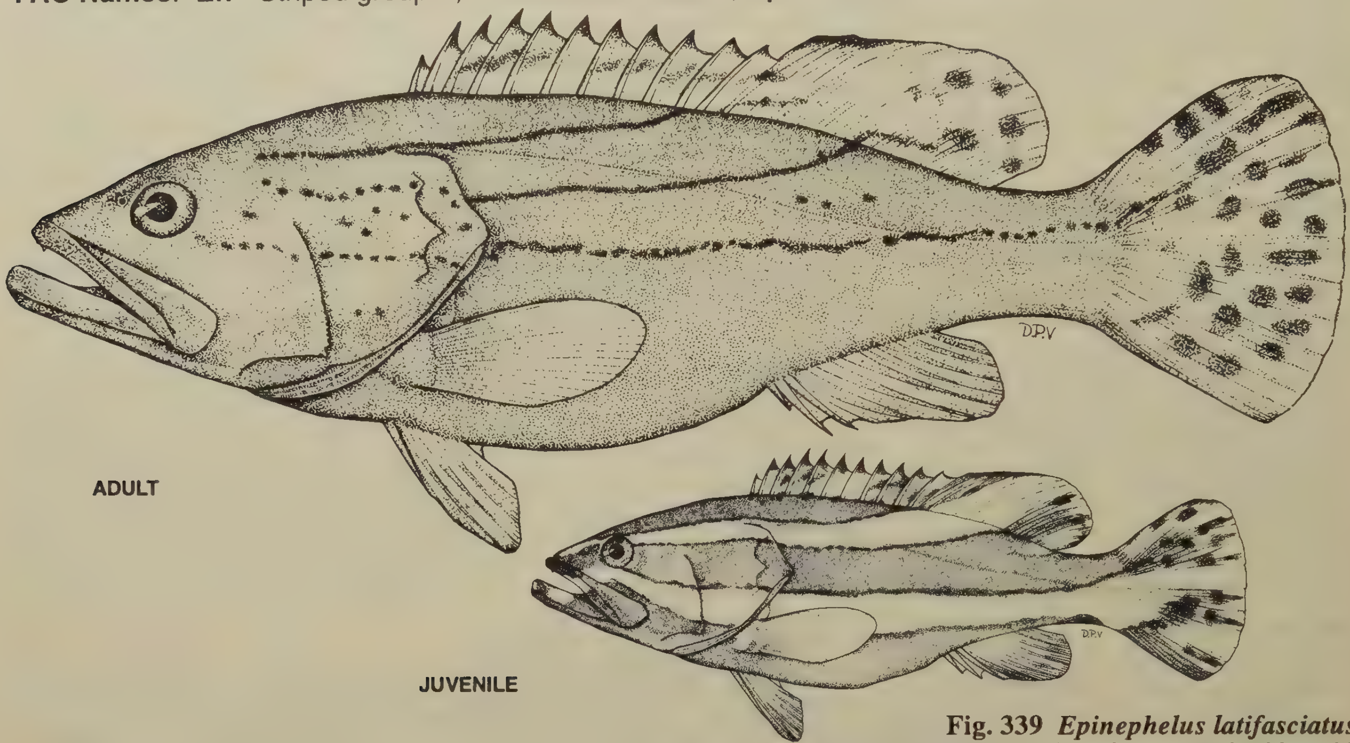


Fig. 339 ***Epinephelus latifasciatus***
(adult 292 mm standard length, juvenile 76 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.4 times in standard length (for fish 13 to 62 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area convex, the dorsal head profile convex; preopercle angular, with 3 to 7 distinctly enlarged serrae at angle; upper edge of operculum distinctly convex; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth. Gill rakers 8 to 11 on upper limb, 15 to 18 on lower limb. Dorsal fin with XI spines and 12 to 14 rays, the third or fourth spine longest, contained 2.9 to 3.9 times in head length and not much shorter than longest rays, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.8 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.2 to 2.6 times in head length; caudal fin truncate in large adults, the rear margin convex in juveniles. Lateral-body scales smooth; lateral-line scales 56 to 65; lateral-scale series 91 to 106. **Colour**: Juveniles lavender-grey or pale brownish, shading to whitish ventrally; 2 black-edged white longitudinal bands, the upper band from above eye to anterior dorsal-fin rays, and the lower band from below eye to lower caudal-fin rays; dorsal and caudal fins with black spots and streaks; white bands disappearing on adults, the dark edges breaking into dashes and spots; head and body of large adults uniformly grey.

Geographical Distribution: Indo-West Pacific region, including the Red Sea, Persian Gulf, Gulf of Oman, Pakistan, coast of India, Viet Nam, Hong Kong, China (Shanghai), Korea, southern Japan, Taiwan, and northwest Australia (Fig. 340). *E. latifasciatus* seems to prefer continental localities, but it is not known from the east coast of Africa, islands of the Indian Ocean, Indonesia, Philippines, or New Guinea.

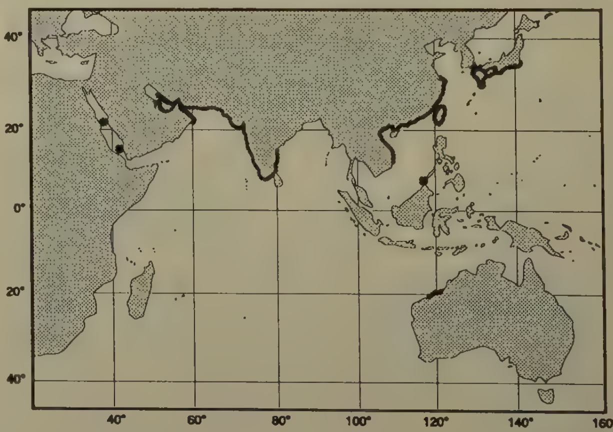


Fig. 340

Habitat and Biology: The preferred habitat seems to be bottoms of low relief; adults are taken on coarse sand or rocky areas, while juveniles are found on silty-sand and mud bottom. Depths range from 20 to at least 230 m.

Size: Attains 137 cm standard length (157 cm total length) and a weight of 58.6 kg.

Interest to Fisheries: Common in markets of the Persian Gulf, Hong Kong, Singapore, and Japan. Caught with hook-and-line, longline, trawl, and traps.

Local Names: HONG KONG: Laterally-banded grouper, Saw-law-paan; JAPAN: Osujihata; KUWAIT: Burtam; SINGAPORE: Lined grouper.

Literature: Chan (1968); Randall and Heemstra (1991).

Remarks: Heemstra and Randall (1984) illustrated a specimen of 292 mm standard length as a "juvenile" of *E. epistictus*.

Epinephelus lebretonianus (Hombron and Jacquinot, 1853) Fig. 341 SERRAN Epin 84

Serranus lebretonianus Hombron and Jacquinot, 1853:33, pl. 1, fig. 3 (type locality unknown).

Synonyms: None.

FAO Names: **En** - Mystery grouper; **Fr** - Mérou arcane; **Sp** - Mero misterioso.

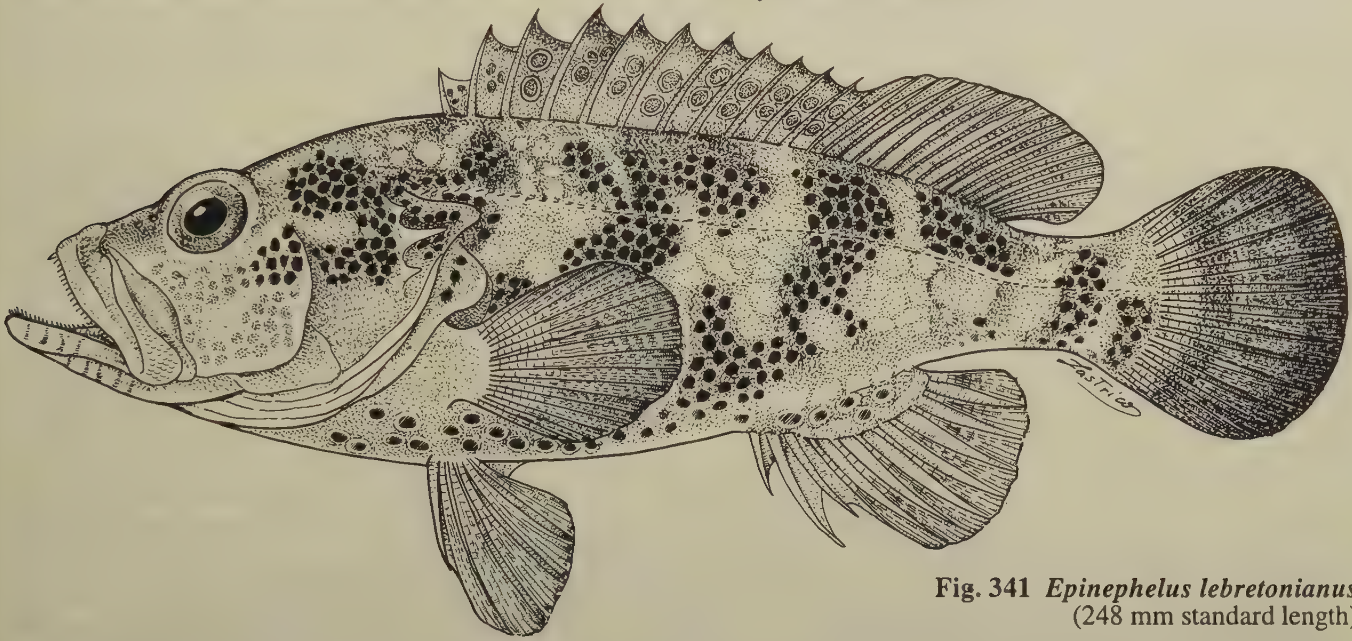


Fig. 341 ***Epinephelus lebretonianus*** (248 mm standard length)

Diagnostic Features: Body depth contained 3.4 times in standard length (for fish 248 mm standard length). Head length contained 2.3 times in standard length; interorbital area slightly convex; preopercle margin finely serrate, the lower rear edge mostly smooth; posterior nostrils slightly larger than anterior nostils; maxilla reaches vertical at rear edge of orbit; midlateral part of lower jaw with 3 rows of teeth. Gill rakers 7 on upper limb, 17 to 18 on lower limb. Dorsal fin with XI spines and 17 rays, the fourth and fifth spines longest, their length contained 3.5 times in head length and shorter than longest dorsal-fin ray, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 20; pectoral-fin length contained 1.9 times in head length; pelvic-fin length contained 2.3 times in head length; caudal fin rounded. Lateral-body scales ctenoid; lateral-line scales 73; lateral-scale series about 120. **Colour**: Body mottled with brown and covered with small, close-set, dark brown spots; median fins brown, with small blue-edged brown ocelli, the fin margin blackish; paired fins whitish proximally, brown distally.

Geographical Distribution: Probably Indo-Pacific (Fig. 342).

Habitat and Biology: Unknown.

Size: The single known specimen is 248 mm standard length.

Interest to Fisheries: None.

Local Names:

Literature: Hombron and Jacquinot (1853); Randall and Heemstra (1991).

Remarks: *E. lebretonianus* is known only from the holotype, which was collected during the circum-global voyage of the corvettes "*L'Astrolabe*" and "*La Zélée*,"

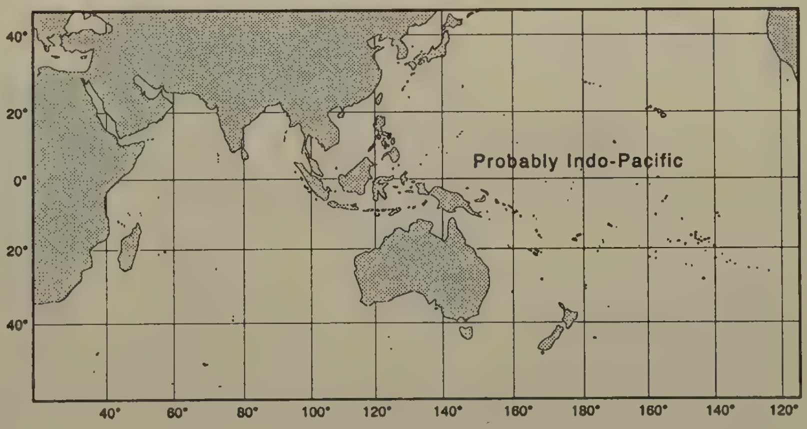


Fig. 342

which were attempting to find the South Pole. Hombron and Jacquinot (1853) noted that the provenance of this specimen was unknown; since most of the fishes reported from this voyage were from the Indo-Pacific region, it seems likely that *E. lebretonianus* was also collected in the Indo-Pacific region.

Epinephelus longispinis (Kner, 1864)

Fig. 343; Pl. XVIIA

SERRAN Epin 36

Serranus longispinnis Kner, 1864:483; 1865:275, pl. 2, fig. 2 (type locality: Madras, India).

Synonyms: None, but often misidentified as "*Epinephelus gaimardi*" (a synonym of *E. miliaris*), "*E. fario*" (a *nomen dubium*), or "*E. maculatus*."

FAO Names: **En** - Longspine grouper (formerly: Streakyspot grouper); **Fr** - Mérou longues épines; **Sp** - Mero espigón.

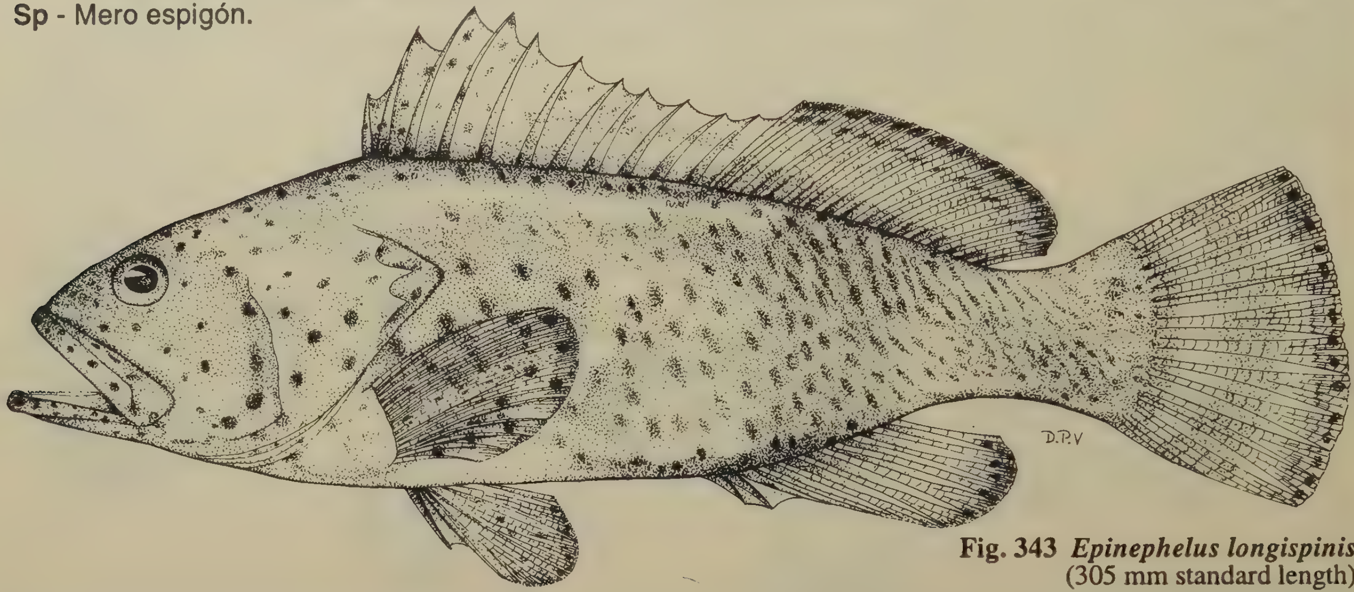


Fig. 343 *Epinephelus longispinis*
(305 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 13 to 35 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat to slightly convex, the dorsal head profile convex; preopercle corner with enlarged serrae and a shallow indentation just above the corner; upper edge of operculum straight or slightly convex; posterior nostrils not much larger than anterior nostrils; maxilla reaches to or past vertical at rear edge of eye, the ventral edge with a blunt hook-like process distally in fish larger than 35 cm standard length; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 11 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.1 to 2.6 times in head length and distinctly longer than longest dorsal rays, the interspinous membranes slightly incised between anterior spines and not incised between posterior spines; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.5 to 1.9 times in head length; pelvic fins not reaching anus, their length contained 1.8 to 2.2 times in head length; caudal fin convex. Lateral-body scales distinctly ctenoid, with numerous auxiliary scales; lateral-line scales 49 to 53; lateral-scale series 98 to 121. **Colour**: Head and body pale; greyish brown, covered with small, dark reddish brown spots that are round and widely spaced on head and front half of body, but obliquely elongated, closer together and darker posteriorly; fins with similar dark brown spots; a row of dark spots along distal margin of soft dorsal and caudal fins. Juveniles with fewer dark spots on head and body, and 2 to 4 dark blotches on body at base of dorsal fin and extending onto fin; ventral part of head and body with irregular white spots; white blotch on upper part of operculum.

Geographical Distribution: Continental and insular localities in the Indian Ocean from Kenya to South Africa (32°S) and east to the Watubela Group of the eastern Banda Sea, including Madagascar, Comoros, Aldabra, Seychelles, Chagos Islands, Mauritius, Réunion, Maldives, Lakshadweep Islands, India, Sri Lanka, Nicobars, and the Nazareth Bank (Fig. 344). Not known from the Red Sea or Persian Gulf.

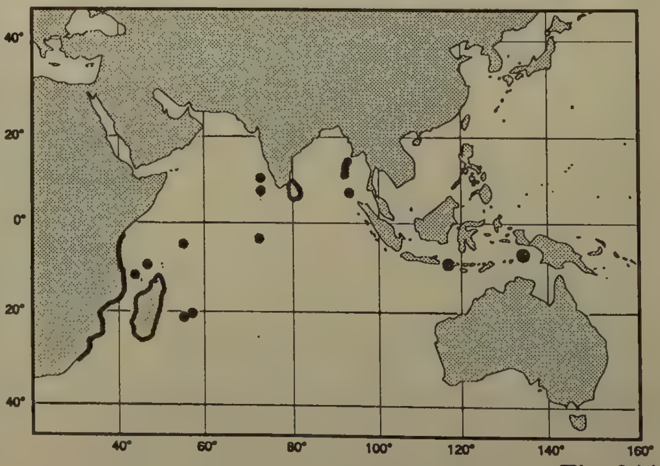


Fig. 344

Habitat and Biology: *E. longispinis* is usually found on coral reefs or rocky areas and occasionally on sandy bottom; depths of capture range from 1 to 70 m. Feeds mainly on crustaceans, especially crabs and stomatopods, and rarely on fish and squid.

Size: Attains at least 46 cm standard length, 2.7 kg.

Interest to Fisheries: Not uncommon. Caught with hook-and-line, spear, traps, and in trawls.

Local Names: INDIA: Fullichammam (Lakshadweep Islands); SOUTH AFRICA: Streakyspot rockcod.

Literature: Morgans (1982); Randall and Heemstra (1991).

Remarks: *E. longispinis* is similar to *E. maculatus* in counts of fin rays, scales, and gill rakers, and also in morphometric features, elevated anterior dorsal-fin spines, and a distinct step-like indentation on ventral edge of maxilla. Juveniles are somewhat similar in colour pattern: brown with small scattered dark spots on body, larger dark spots on fins, and irregular white spots and blotches on head and body. Adults of *E. maculatus* differ in having all the dark spots on head and body round (none elongated into oblique streaks) and close-set (not more crowded posteriorly), large pale blotch on middle of dorsal fin, and no row of dark spots along rear edge of caudal fin. These two species occur together in Indonesia; the junior author (J.E.R.) observed and photographed both species at Bali.

Epinephelus macrospilos (Bleeker, 1855) Fig. 345; Pl. XVIIB-D SERRAN Epin 32

Serranus macrospilos Bleeker, 1855e:499 (type locality: Batjan, Moluccas).

Synonyms: *Serranus cylindricus* Günther, 1859:151 (type locality: Madagascar). Often confused with *Epinephelus quoyanus*, *E. faveatus*, *E. corallicola*, and *E. howlandi*.

FAO Names: **En** - Snubnose grouper (formerly: Bigspot grouper); **Fr** - Mérou tapis; **Sp** - Mero alfombrado.

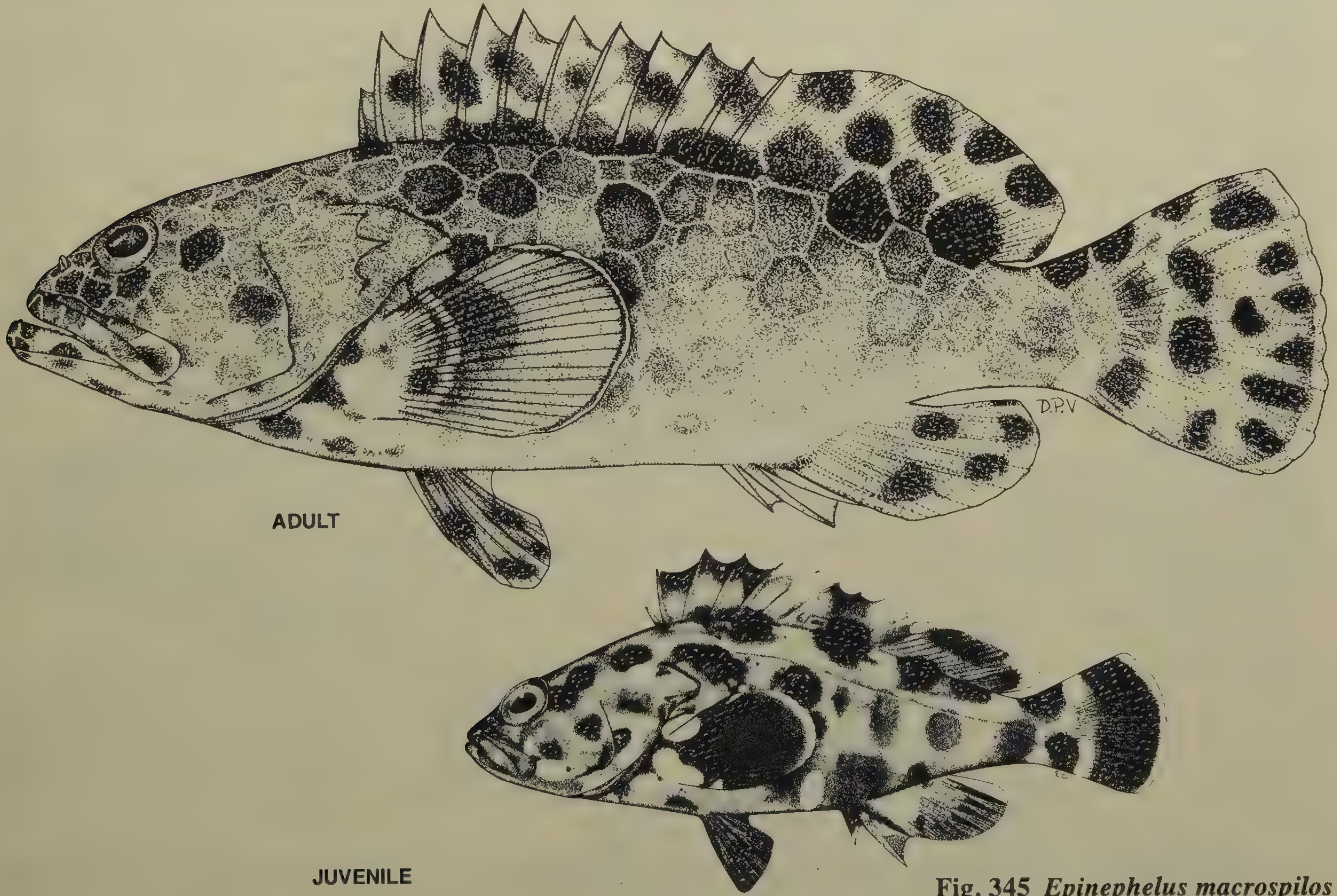


Fig. 345 *Epinephelus macrospilos*
(adult 186 mm standard length, juvenile 55 mm standard length)

Diagnostic Features: Body depth contained 3.0 to 3.6 times in standard length (48 specimens 10 to 43 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat or slightly concave, the dorsal head profile of adults with a ventral bend at orbits; preopercle rounded, with minute serrae mostly covered by skin and a shallow indentation just above the "corner"; upper edge of operculum straight or slightly convex; posterior nostrils usually distinctly larger than anteriors; maxilla reaches to or past vertical at rear edge of orbit, the ventral edge smoothly curved at distal expansion; lower jaw strongly projecting, the midlateral part with 2 to 4 rows of teeth. Gill rakers 7 to 9 on upper limb, 14 to 17 on lower limb, 21 to 26 total. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.3 to 3.4 times in head length and shorter than longest dorsal-fin rays, the interspinous membranes moderately incised; anal fin with III spines and 8 rays, the second and third spines subequal, their length contained 2.8 to 4.2 times in head length; pectoral-fin rays 17 to 20; pectoral-fin length contained 1.5 to 2.0 times in head length; pelvic-fin length 1.8 to 2.5 times in head length; caudal-peduncle depth contained 3.2 to 3.7 times in head length; caudal fin rounded; length of middle caudal-fin rays contained 1.5 to 2.0 times in head length. Lateral-body scales smooth, except for area covered by pectoral fins; lateral-line scales 48 to 52; lateral-scale series 86 to 103. Pyloric caeca 25 to 27. **Colour**: Pacific Ocean specimens: Head and body pale greyish brown with dark brown spots (centre of spots darker than the diffuse edges) that are large and well-separated in young, becoming relatively smaller, more numerous and closer together in adults; median and pelvic fins with similar dark spots; pectoral fins usually dusky, with white line along the edge and usually a few faint dark spots; some specimens with a faint oblique dark line across lower part of chest; median fins with narrow pale margin posteriorly; no dark spots on underside of lower jaw. Indian Ocean specimens: Head and body with round to polygonal brown to dark brown spots, variable in size (some spots on juveniles may be as large as eye) and close-set, the narrow interspaces forming a pale network pattern; median fins yellowish, with blackish brown spots like those on body; soft dorsal, caudal, and anal fins with pale margin; underside of lower jaw usually with dark spots.

Small juveniles (5 to 7 cm standard length) with dark spots on head and body fewer and much larger than in adults, those on caudal fin represented by a broad black area covering two-thirds of the fin; Pacific Ocean juveniles with prominent white blotches as shown in figure.

Geographical Distribution: Indo-Pacific region from east coast of Africa (Kenya to Natal, South Africa) to the central Pacific, including Madagascar, Comoros, Mascarenes, Seychelles, Chagos, Nicobars, Cocos-Keeling, Western Australia (Scott Reef), Indonesia, Okinawa, Great Barrier Reef, Marquesas Islands, and most western Pacific islands (both on and off the Pacific Plate) (Fig. 346). *E. macrospilos* is not known from the Red Sea, Persian Gulf, or Hawaii.

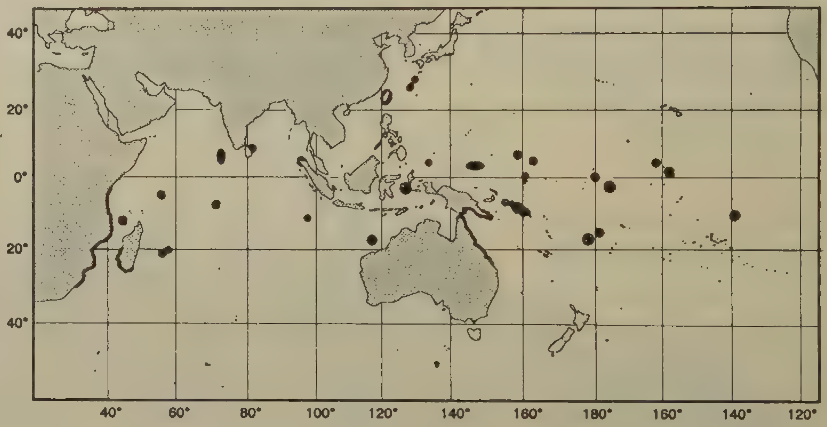


Fig. 346

Habitat and Biology: Coral reefs to depths of at least 44 m. Feeds on crustaceans (mainly crabs), fishes, octopuses, and squids.

Size: Attains at least 43 cm standard length and 2.0 kg.

Interest to Fisheries: *E. macrospilos* is common in some areas and is undoubtedly important in artisanal fisheries. It is caught with hook-and-line, spear, and traps.

Local Names: Because of confusion with similarly coloured species, the application of specific local names to this species is uncertain.

Literature: Morgans (1982); Randall and Heemstra (1991).

Remarks: Specimens from the western Indian Ocean differ from those in the eastern Indian and Pacific oceans in usually having dark spots on the underside of the jaw, and the dark spots on the head and body are larger and close-set, forming a pale mesh dorsally on fresh specimens. But we are unable to find any other differences between specimens of these two populations. Burgess and Axelrod (1974) illustrated the colour pattern of juveniles (figs 230 to 232, photographs by Shih-chieh Shen of specimens 6 to 9 cm standard length from Taiwan labelled "*Epinephelus tauvina*").

E. macrospilos was illustrated as "*Epinephelus quoyanus*" by Masuda and Allen (1987:116; and the same specimen was illustrated by Katayama, 1988:pl. 115, fig. E, as *E. faveatus*) and Gloerfelt-Tarp and Kailola (1984:134).

E. macrospilos seems to be replaced along the coast of India and Sri Lanka by the closely related *E. faveatus*; and along the northern coast of Australia, it seems to be excluded by *E. quoyanus*. *E. macrospilos* and *E. quoyanus* both occur at the Riu Kiu Islands, Taiwan, Moluccas and probably at other localities in Indonesia.

E. macrospilos was compared with ***E. bilobatus***, ***E. corallicola***, ***E. faveatus***, ***E. hexagonatus***, and ***E. howlandi*** in the accounts of these species. Western Indian Ocean specimens of *E. macrospilos* are often confused with the other "reticulated groupers" (***E. bilobatus***, ***E. faveatus***, ***E. hexagonatus***, ***E. maculatus***, ***E. melanostigma***, ***E. merra***, ***E. quoyanus***, and ***E. spilotoceps***).

E. maculatus has the dorsal-fin membranes not incised between the spines; lateral-body scales ctenoid, lateral-scale series 102 to 120; juveniles are yellowish brown, with irregular white spots and blotches on head, body, and dorsal fin and a few small black spots on head and fins.

E. melanostigma has the lateral-body scales ctenoid, lateral-line scales 56 to 68, and a large black blotch (which extends halfway to dorsal-fin margin) on body at base of last 4 dorsal-fin spines.

E. merra has the lateral-body scales ctenoid, and pectoral fins covered with distinct small black spots mainly confined to the rays.

E. quoyanus has larger pectoral fins (their length contained 1.2 to 1.7 times in head length), lateral-body scales distinctly ctenoid, chest with 2 oblique dark brown bands (or large blotches linked by narrow bands), pectoral fins with semicircular reddish brown blotch covering most of the base, and small juveniles are coloured essentially like the adults.

E. spilotoceps has the lateral-body scales ctenoid, lateral-line scales 59 to 69, black spots on snout about size of nostrils, and caudal-peduncle depth contained 3.7 to 4.3 times in head length.

Epinephelus maculatus (Bloch, 1790) Fig. 347; Pl. XVIIE SERRAN Epin 85

Holocentrus maculatus Bloch, 1790:96, pl. 242, fig. 3 (type locality: East Indies).

Synonyms: ***Holocentrus albo-fuscus*** Lacepède, 1802:384 (type locality: East Indies). ***Serranus Sebae*** Bleeker, 1854:488 (type locality: Ambon, Indonesia). ?***Plectropomus kulas*** Thiollière in Montrouzier, 1856:423 (type locality: Woodlark Island, Solomon Sea). ***Serranus medurensis*** Günther, 1873:8, pl. 9, fig. A (type locality: Majuro, Marshall Islands).

FAO Names: **En** - Highfin grouper; **Fr** - Mérou haute voile; **Sp** - Mero aleta alta.

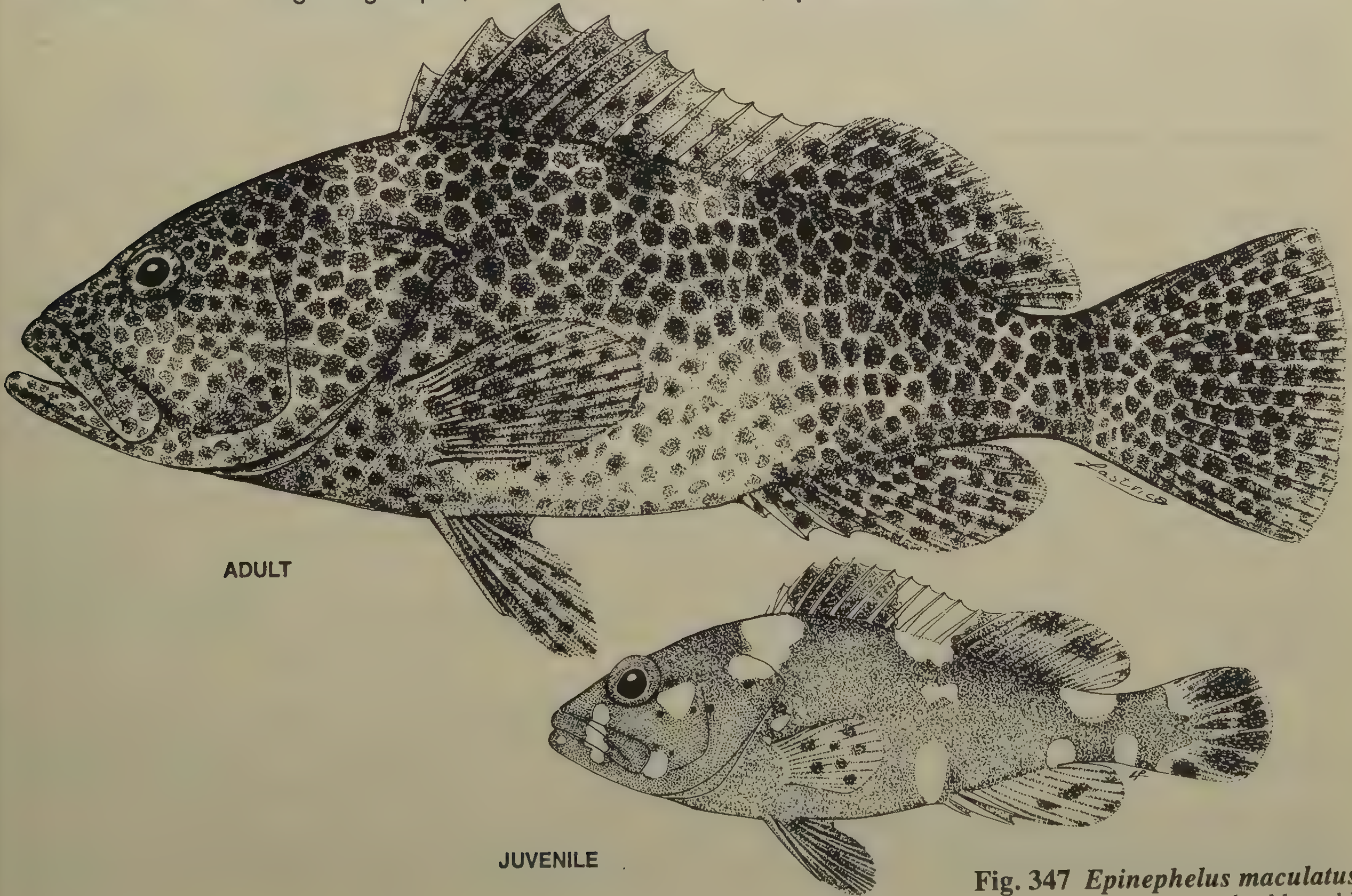


Fig. 347 ***Epinephelus maculatus***
(adult 400 mm standard length, juvenile 80 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.1 times in standard length (for fish 11 to 37 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat to slightly convex, the dorsal head profile convex; preopercle with a shallow indentation just above the enlarged serrae at the corner; upper edge of operculum straight or slightly convex, nostrils subequal; maxilla reaches to or past vertical at rear edge of eye, the ventral edge with a blunt hook-like process distally in fish larger than 35 cm standard length; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.1 to 2.6 times in head length and distinctly longer than dorsal-fin rays, the interspinous membranes slightly incised between anterior spines and not incised posteriorly; anal fin with III spines and 8 rays, the third spine longest, its length contained 3.3 to 4.1 times in head length and equal to or less than depth of caudal peduncle; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.5 to 1.9 times in head length; pelvic fins reaching to or near anus; their length contained 1.7 to 2.0 times in head length; caudal fin convex or rounded. Lateral-body scales distinctly ctenoid, with numerous auxiliary scales; lateral-line scales 49 to 52; lateral-scale series 102 to 120. Pyloric caeca 30 to 45. **Colour**: Head, body, and fins of adults pale brown, covered with small, round to hexagonal, close-set, dark brown spots, extending onto belly, chest and underside of head; 2 large diffuse dusky areas on dorsal part of body and dorsal fin, the largest extending over dorsal fin from second to fifth spines, the second dark blotch from tenth spine to second soft-ray, the dorsal fin pale between these 2 dusky blotches, but with small dark spots. One resting colour phase is broadly mottled with large dark and pale areas; in the pale areas, the usual dark brown spots are mostly whitish, with small dark brown centres. Small juveniles (4 to 8 cm standard length) yellowish brown, with well-separated small black spots (mainly on head and fins) and prominent, irregular white blotches and spots, the largest on middle of dorsal fin.

Geographical Distribution: Eastern Indian Ocean and Western Pacific from Cocos-Keeling Islands, Indonesia, Hong Kong, Ryukyu Islands, Ogasawara Islands, Philippines, New Guinea, Great Barrier Reef, Lord Howe Island, New Caledonia, New Ireland, Fiji, Samoa, Palau, Caroline Islands, Marshall Islands, and Kiribati (Gilbert Islands) (Fig. 348).

Habitat and Biology: Coral reefs at depths of 2 to 100 m. Prey comprises mainly small fishes, crabs, and octopuses.

Size: Attains at least 50 cm standard length.

Interest to Fisheries: Not common, but probably of commercial interest in artisanal fisheries. Caught with hook-and-line, spear, and traps.

Local Names: HONG KONG: Cheung-gig-paan; JAPAN: Shirobuchihata.

Literature: Randall and Heemstra (1991).

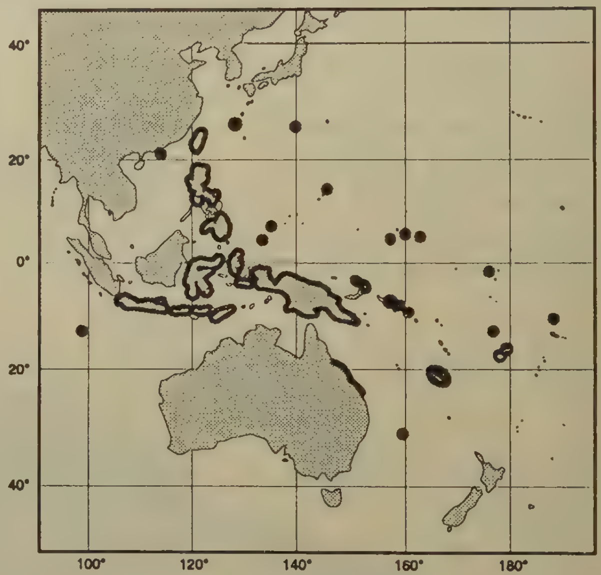


Fig. 348

Remarks: *E. maculatus* was compared with *E. longispinis* in that species account. *E. bilobatus* differs from *E. maculatus* in having 17 or 18 dorsal-fin rays, fewer lateral-scale series (94 to 102) and 3 bilobed dark blotches or close-set pairs of dark brown or black spots along body and base of dorsal fin; it also lacks the 2 large blackish areas on body and dorsal fin where they are separated by a large pale area with small dark spots.

E. maculatus is one of 9 "reticulated coral-reef groupers", which have a rounded caudal fin and close-set dark brown spots, resulting in pale interspaces forming a network on the body. The other species in this group are *E. bilobatus*, *E. faveatus*, *E. hexagonatus*, *E. macrospilos*, *E. melanostigma*, *E. merra*, *E. quoyanus* and *E. spilotoceps*. These species have been much confused in the literature, and many museum specimens have been misidentified. *E. maculatus* differs from all of the other "reticulated groupers" in having the dorsal-fin membranes not (or only slightly) incised between the fin spines, and in the colour pattern of small juveniles (4 to 8 cm standard length) being quite different from larger juveniles (15 cm standard length) and adults.

Epinephelus magniscuttis Postel, Fourmanoir and Guézé, 1963

Fig. 349;
Pl. XVIIF

SERRAN Epin 37

Epinephelus magniscuttis Postel, Fourmanoir and Guézé, 1963:365, fig. 9 (type locality: Réunion).

Synonyms: *Epinephelus pseudomorrhua* Postel, Fourmanoir and Guézé, 1963:366, fig. 10 (type locality: Réunion).

FAO Names: **En** - Speckled grouper; **Fr** - Mérou grandes écailles; **Sp** - Mero bacalao.

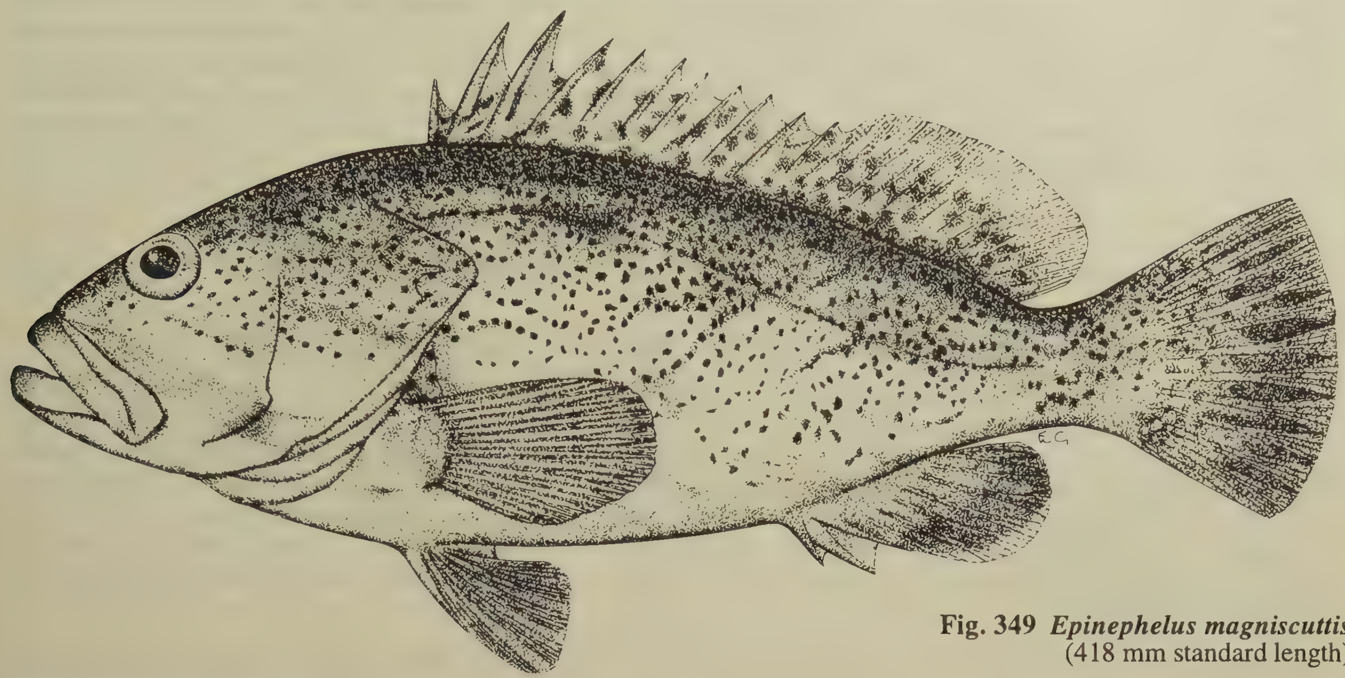


Fig. 349 ***Epinephelus magniscuttis***
(418 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.2 times in standard length (for fish 13 to 42 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area flat to convex, the dorsal head profile almost straight; preopercle angular, with 2 to 4 distinctly enlarged serrae at angle; upper edge of operculum slightly convex; posterior nostrils not much larger than anterior nostrils; maxilla reaches to below rear half of eye, the ventral edge with a low step at the distal expansion; midlateral part of lower jaw with 2 rows of teeth, the inner teeth larger than outer ones. Gill rakers 8 or 9 on upper limb, 16 or 17 on lower limb. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its depth contained 2.5 to 3.0 times in head length and longer than longest dorsal-fin ray, the interspinous membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.7 to 2.0 times in head length; pelvic fins not reaching anus, their length contained 2.1 to 2.3 times in head length. Lateral-body scales distinctly ctenoid and without auxiliary scales; lateral-line scales 55 to 62; lateral-scale series 103 to 122. Pyloric caeca 7. **Colour**: Generally pale brown, with small dark brown (or greyish green?) spots unevenly scattered on dorsolateral parts of head (posterior to eyes) and body, dorsal fin and caudal fin; no spots on body below level of pectoral fins or on anal and paired fins. According to Postel et al. (1963), juveniles have 6 or 7 dark lines running horizontally along the body and these disappear with age.

Geographical Distribution: Indo-West Pacific from Natal, South Africa, Mozambique, Réunion, Mauritius, New Caledonia, Philippines, New Guinea, New Ireland, and Fiji. Not known from the Red Sea or Persian Gulf (Fig. 350).

Habitat and Biology: *E. magniscuttis* is known only from deep water (128 to 300 m) in the vicinity of coral reefs. Biology unknown.

Size: According to Postel et al. (1963), this species attains 150 cm total length and a weight of 50 kg.

Interest to Fisheries: An excellent food fish; apparently of some commercial importance at Réunion, where it is fairly common.

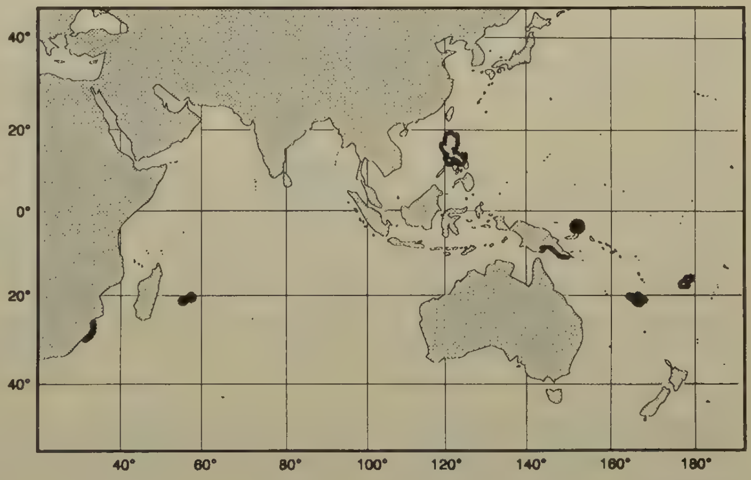


Fig. 350

Local Names: MAURITIUS: Vieille Saint-Sillac;
REUNION: Cabot grosse écaille, Petit nègre, Cabot de fond, Cabot aux yeux vert.

Literature: Randall and Heemstra (1991).

Remarks: *E. magniscuttis* is closely related to *E. epistictus*, which has fewer (and smaller) dark spots on the head and body, and in juveniles the dark spots are arranged in 3 longitudinal rows on the body.

E. pseudomorrhua was described by Postel et al. (1963) in the same paper with their description of *E. magniscuttis*. These two species were separated in their key to species on the basis of scale counts (*E. magniscuttis* was said to have only about 75 lateral-scale series), but they were not otherwise compared. The colour patterns that they illustrated for these two species are virtually identical, and both species were caught only in deep water. We have not been able to examine the holotype of *E. magniscuttis* (which was deposited at the oceanographic station in Nossi Bé, Madagascar), but if the lateral-scale count is not erroneous, it probably represents an individual anomaly.

Epinephelus malabaricus (Bloch and Schneider, 1801) Fig. 351; Pl. XVIIIA SERRAN Epin 38

Holocentrus malabaricus Bloch and Schneider, 1801:319, pl. 63 (type locality: Tranquebar, India).

Synonyms: *Holocentrus salmoïdes* Lacepède, 1802:389; 1801:pl. 34, fig. 3 (type locality: "Grand Océan" [based on a drawing from the manuscripts of Commerson, hence the locality is probably Mauritius]). *Serranus semi-punctatus* Valenciennes in Cuv. and Val., 1828:341 (type locality: Pondicherry, India). *Serranus salmonoides* Valenciennes in Cuv. and Val., 1828:343 (emendation and redescription of *Holocentrus salmoïdes* Lacepède, 1802). *Serranus crapao* Cuvier in Cuv. and Val., 1829:494 (type locality: Jakarta, Indonesia). *Serranus polypodophilus* Bleeker, 1849:37 (type locality: Jakarta). ?*Serranus estuarius* Macleay, 1884:200 (type locality: Mary River, Queensland, Australia). *Epinephelus cylindricus* Postel, 1965:124, fig. 1 (type locality: Nouméa, New Caledonia).

FAO Names: **En** - Malabar grouper; **Fr** - Mérou malabare; **Sp** - Mero malabárico.

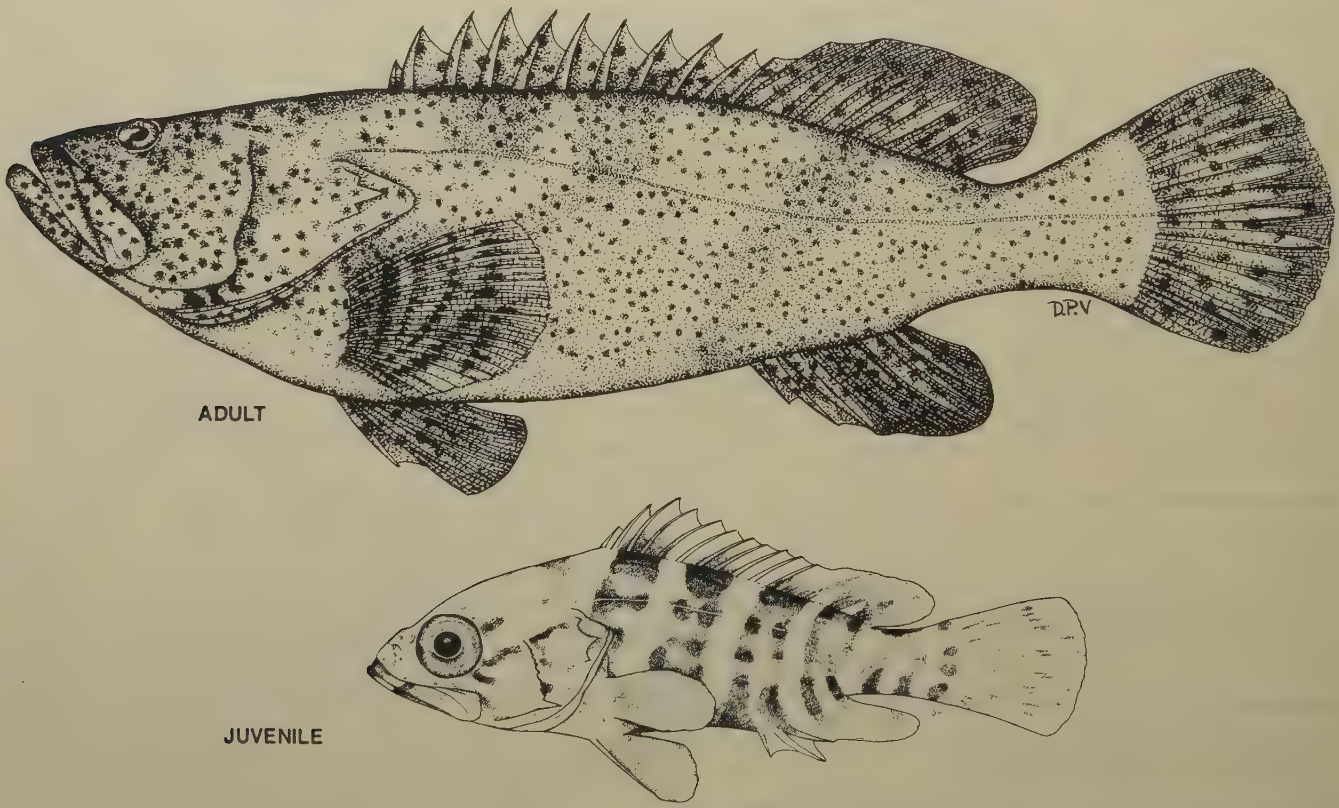


Fig. 351 ***Epinephelus malabaricus***
(adult 500 mm total length, juvenile 23 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.7 times in standard length (for fish 15 to 69 cm standard length); body width contained 1.4 to 1.9 times in the depth. Head length contained 2.3 to 2.6 times in standard length; snout length contained 1.7 to 2.0 times in upper jaw length; interorbital width contained 4.5 to 6.5 times in head length and 2.1 to 3.0 times in upper jaw length; interorbital area flat or slightly convex; preopercle subangular, with enlarged serrae at the angle; upper edge of operculum almost straight; nostrils subequal, except in large adults which have the posterior nostrils slightly larger; maxilla extends past vertical at rear edge of orbit, maxilla width 4.5 to 6.5 % of standard length; upper jaw length 17 to 22% of standard length, midlateral part of lower jaw with 2 to 5 rows of teeth. Gill rakers 8 to 11 on upper limb, 14 to 18 on lower limb, 23 to 27 total; rudiments difficult to distinguish from small bony platelets on outer face of first gill arch. Dorsal fin with XI spines and 14 to 16 rays, the third to fifth spines usually slightly longer than posterior spines, their length contained 3.1 to 4.0 times in head length and distinctly shorter than longest rays, the interspinous membranes incised; anal fin with III spines and 8 rays, the third spine usually longest; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.7 to 2.2 times in head length, pelvic-fin length contained 2.1 to 2.6 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 54 to 64; anterior lateral-line tubes of large adults with 2 to 4 branches; lateral-scale series 101 to 117. Pyloric caeca numerous (more than 80 branches). **Colour**: Head and body brownish, covered with small, well-separated, blackish brown spots which extend onto chest, lower jaw and gular area and roof of mouth; head and body also with scattered white spots and blotches; 5 irregular, oblique, dark brown bars (more or less interrupted by pale spots) often visible on body; fins with scattered small black spots.On preserved fish the blackish spots are conspicuous against the drab background.

Geographical Distribution: *E. malabaricus* is known from the Red Sea and Indo-Pacific area (South Africa to Japan, Australia, Palau, Yap and Fiji). It occurs in continental and insular localities: Gulf of Aqaba, Sudan, Saudi Arabia, Djibouti, Ethiopia, Kenya, Zanzibar, Tanzania, Mozambique, Oman, Madagascar, Comoros, Seychelles, India, Sri Lanka, Andaman Islands, Indonesia, Singapore, Philippines, Taiwan, China, Papua New Guinea, New Ireland, Caroline Islands, New Caledonia, and Tonga. In Australia, it occurs from the Northern Territory to New South Wales (Fig. 352). It is not known from the Persian Gulf, where the closely related *E. coioides* is common.

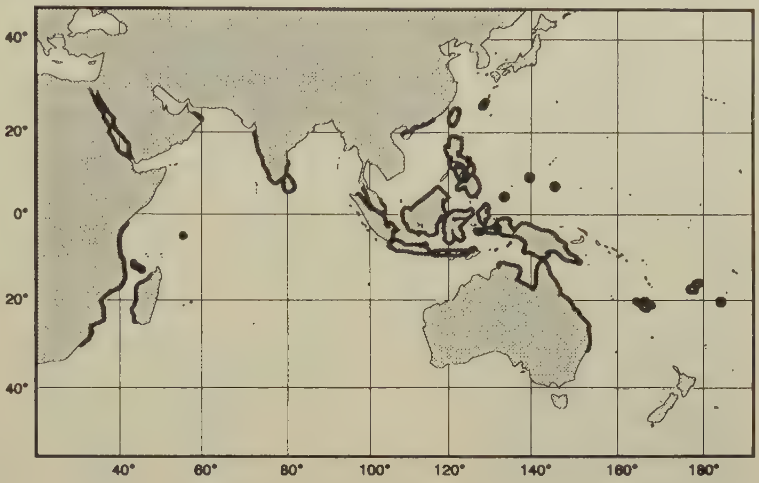


Fig. 352

E. malabaricus was reported from the Mediterranean coast of Israel by Randall and Ben-Tuvia (1983), based on the record of "*Epinephelus tauvina*" by Ben-Tuvia and Lourie (1969); but their "*E. tauvina*" were said to have "Head and body covered with bright orange spots more or less regularly dispersed ..." which would rule out *E. malabaricus*. The specimen in question, which is now deposited at the Hebrew University in Jerusalem, was recently reexamined by P.C. Heemstra and identified as *E. coioides*, which does have orange or reddish brown spots, is very similar to *E. malabaricus*, and has recently been reported from the Mediterranean (Heemstra, 1991). Although the original record of "*E. malabaricus*" in the Mediterranean (Randall and Ben-Tuvia, 1983), was based on *E. coioides* (which Randall and Ben-Tuvia (1983) confused with *E. malabaricus*), we have recently examined a specimen of *E. malabaricus* (deposited at the Hebrew University in Jerusalam) that was collected at Nahariya on the Mediterranean coast of Israel in June 1966. We also saw a live specimen that was collected in Haifa Bay and is presently residing at the National Center for Mariculture in Eilat.

Habitat and Biology: *E. malabaricus* is a common species that is found in a variety of habitats: coral and rocky reefs, tidepools, estuaries, mangrove swamps and sandy/mud bottom from shore to depths of 150 m. It feeds equally on fishes and crustaceans and occasionally on octopuses. No information is available on age and growth of this species.

Size: Tan et al. (1982) illustrated a 97.4 cm standard length specimen (= 115 cm total length). Attains at least 25 kg. The maximum size is uncertain because of confusion with other species of large groupers.

Interest to Fisheries: *E. malabaricus* is undoubtedly one of the most important groupers in fisheries of the Indo-Pacific region. Because of the confusion of this species with *E. coioides* (= *E. suillus*) and *E. tauvina*, there are no statistical data available for *E. malabaricus*. But this species is one of the most common groupers in markets of the Indo-West Pacific region, and it is widely used in the aquaculture industry. It is caught with trawls, longlines, traps, spear and hook-and-line.

Local Names: INDIA: Bontoo, Punni-calawah, Kalava, Hekaru, Gobra; JAPAN: Yaitohata; NEW CALEDONIA: Mére loche, Loche ronde; SINGAPORE: Greasy grouper, Keretang, Hua dun hou.

Literature: Heemstra (1991); Randall and Heemstra (1991). Misidentified as *E. tauvina*: Morgans (1966, 1982); Kyushin et al. (1977); Tan et al. (1982).

Remarks: Morgans (1966) distinguished *E. malabaricus* from *E. coioides* and *E. tauvina*, but he used the wrong names for these species: his "*E. tauvina*" is *E. malabaricus*; he described *E. tauvina* as a new species, *E. chewa*; and he identified *E. coioides* as "*E. malabaricus*." He also appears to have mistaken large (greater than 150 cm total length) specimens of *E. lanceolatus* for *E. malabaricus* (which he identified as his "big drab" stage of "*E. tauvina*").

Differences between ***E. malabaricus***, ***E. coioides***, and ***E. tauvina*** are given in the following table:

Table 4

Comparison of *Epinephelus coioides, E. malabaricus,* and *E. tauvina* (for fish of 10 to 61 cm standard length)

	E. coioides	*E. malabaricus*	*E. tauvina*
Spots on head and body	orange or reddish brown; no white spots or blotches	dark brown or black; also with irregular white spots and blotches	dull orange-red to dark brown; also with small faint white spots and blotches
Midlateral-body scales	ctenoid (rough)	ctenoid (rough)	smooth on fish 30-60 cm SL
Head length	2.3-2.6 times in standard length	2.3-2.6 times in standard length	2.1-2.3 times in standard length
Interorbital width	5.0-6.2 times in head length	4.5-6.5 times in head length	6.8-8.1 times in head length
Upper jaw length	17-20% of standard length	17-22% of standard length	21-24% of standard length
Maxilla width	4.2-5.5% of standard length	3.9-5.3% of standard length	5.4-6.5% of standard length
Upper jaw snout length	1.8-1.9	1.7-2.0	2.0-2.4
Upper jaw interorbital width	2.1-3.2	2.1-3.0	3.1-4.0
Lower-limb gill rakers	14-17	14-18	17-20
Lateral-line scales	58-65	54-64	63-74
Pyloric caeca	50-60	more than 80 branches	16-18
Bony platelets on lateral side of first gill arch	present	present	absent
Preopercle shape	angular	angular	broadly rounded

Epinephelus marginatus (Lowe, 1834) Fig. 353; Pl. XVIIIB SERRAN Epin 1

Serranus marginatus Lowe,1834:142 (type locality: Madeira).

Synonyms: ***Serranus fimbriatus*** Lowe, 1836:195, pl. I, fig. 1 (replacement name for ***Serranus marginatus*** Lowe, thought to be preoccupied by ***Serranus marginalis*** Valenciennes, 1828 [which was based on ***Holocentrus marginatus*** Lacepède, 1802, an incorrect spelling of ***Epinephelus marginalis*** Bloch, 1793]). ***Serranus aspersus*** Jenyns, 1843:6 (type locality: Cape Verde Islands). ?***Serranus cernioides*** Capello, 1868:156, pl. 4, fig. 1 (type locality: Lisbon). ***Epinephelus brachysoma*** Cope, 1871:466 (type locality: Rio de Janeiro). ***Epinephelus gigas***: Jordan and Swain, 1885; Jordan and Eigenmann, 1890; Boulenger, 1895 (in part); Barnard, 1927. ***Epinephelus guaza*** (non Linnaeus): Jordan and Evermann, 1896; Smith, 1949; Rivas, 1964; Smith, 1971; Heemstra and Randall, 1984; Heemstra and Randall, 1986.

FAO Names: **En** - Dusky grouper; **Fr** - Mérou noir; **Sp** - Mero moreno.

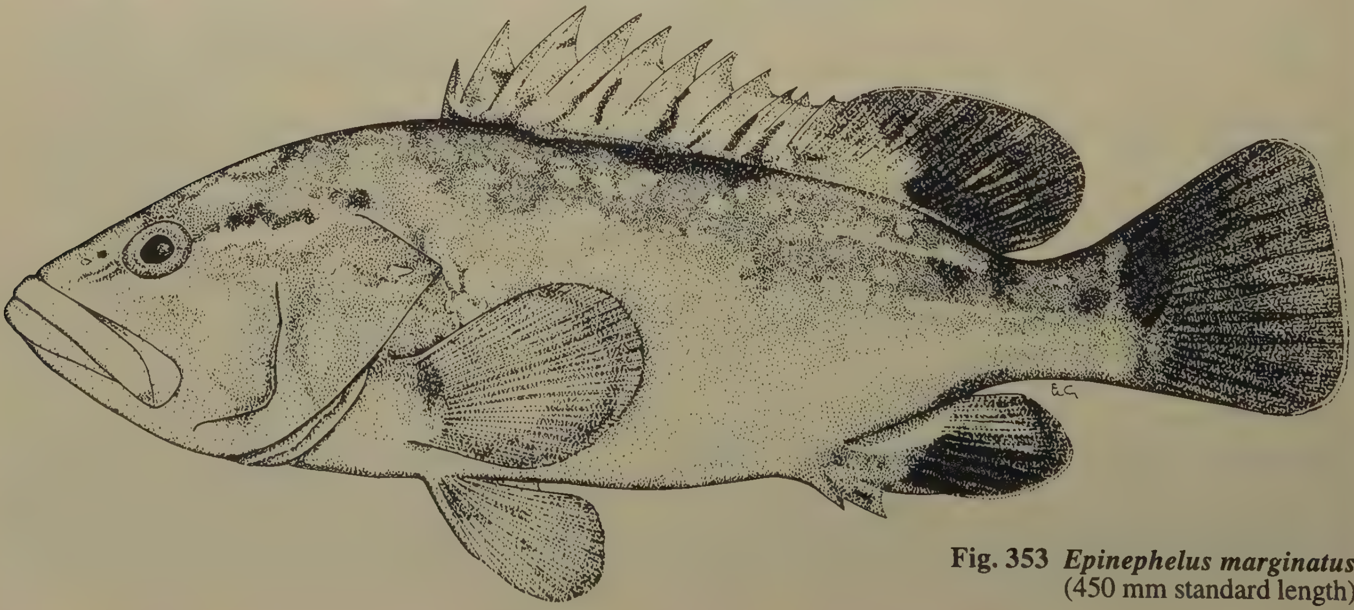


Fig. 353 ***Epinephelus marginatus*** (450 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.6 to 3.1 times in standard length (for fish 15 to 62 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex; preopercle rounded, finely serrate, the serrae at "angle" slightly enlarged; subopercle and interopercle smooth; eye diameter greater than or subequal to interorbital width in fish 10 to 30 cm standard length, less than interorbital in fish over 40 cm standard length; nostrils subequal or rear nostril slightly larger; maxilla naked, reaching to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of subequal teeth. Gill rakers 7 to 10 on upper limb, 14 to 16 on lower limb, total 22 to 25. Dorsal fin with XI spines and 14 to 16 rays, third or fourth spine longest, longer than longest dorsal-fin ray and contained 2.3 to 2.8 times in head length, the interspinous membrane distinctly incised; anal fin with III spines and 8 rays (1 of 87 fish counted with 9 rays); pectoral-fin rays 17 to 19, the fin length contained 1.6 to 2.0 times in head length; pelvic fins distinctly shorter than pectoral fins, not reaching anus (except in some fish less than 20 cm standard length), pelvic-fin length contained 1.8 to 2.4 times in head length; pelvic-fin origin below or slightly posterior to base of pectoral fins; caudal fin rounded (in juveniles) or truncate with rounded corners (large adults). Midlateral-body scales ctenoid (at least in area covered by pectoral fins); adults with numerous auxiliary scales; lateral-line scales 62 to 73; lateral-scale series 98 to 116. Pyloric caeca 26 to 50. **Colour:** Head and body dark reddish brown or greyish dorsally, usually yellowish gold ventrally; irregular white, pale greenish yellow or silvery grey blotches usually visible on body and head and mostly arranged in vertical series; black maxillary streak more or less distinct; median fins dark brown; distal edge of anal fin, caudal fin, and often the pectoral fins narrowly white; pelvic fins blackish distally; pectoral fins dark reddish brown or grey; margin of spinous dorsal fin and basal part of paired fins often golden yellow.

Geographical Distribution: *E. marginatus* occurs on both sides of the Atlantic Ocean, throughout the Mediterranean Sea and round the southern tip of Africa to southern Mozambique and Madagascar. We examined specimens from the Azores, Spain, France, Italy, Greece, Lebanon, Israel, Algeria, Madeira, Canary Islands, Cape Verde Islands, Angola, South Africa, Mozambique, and Brazil (Fig. 354). Based on identifiable records as "*Epinephelus guaza*", the species is also known from Egypt, Tunisia, Morocco, Mauritania, Senegal, Côte-d'Ivoire, and the Congo. According to Wheeler (1969), "*Epinephelus guaza*" is rare in British Seas. Reported from India by Reddy (1984; as "*Epinephelus guaza*"), but we have not examined any Indian Ocean specimens from north of 24°S. In the western Atlantic, *E. marginatus* is known from southern Brazil, and it has also been reported (as "*Epinephelus guaza*") from Uruguay and Argentina by Ringuelet and Aramburu (1960).

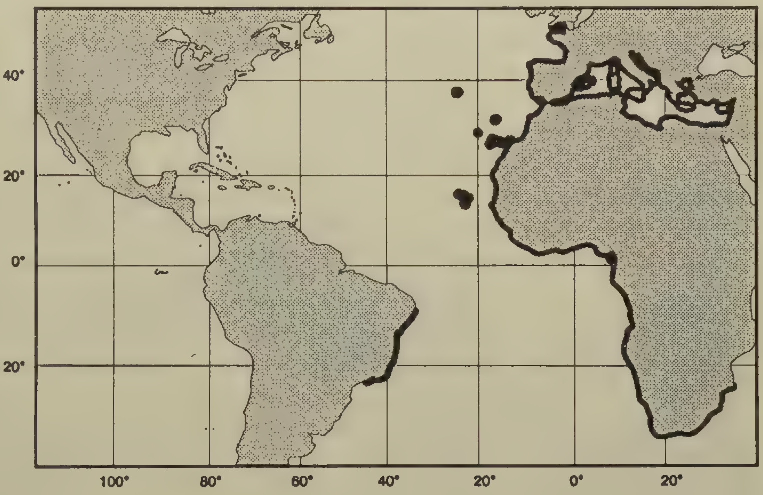


Fig. 354

Habitat and Biology: *E. marginatus* prefers rocky bottoms. It is the most common species of grouper in South African waters, where it is well known as the "yellowbelly rockcod" ("*Epinephelus guaza*"). It occurs from shallow water out to depths of 50 m, and is readily taken by anglers. Smale (1986) found that crabs and octopus were the principal prey and that larger specimens fed on a greater proportion of fishes, of which the majority were reef-associated species.

Considerable information has been published on the age, growth, and reproduction of "*E. guaza*" in the Mediterranean, but many authors who have published on the Mediterranean species of *Epinephelus* (e.g., Boulenger, 1895; Tortonese, 1970; Bauchot and Pras, 1980; Bauchot, 1987) may have confused *E. marginatus* (which they called "*E. guaza*") with the similar species *E. haifensis*. Consequently, it is uncertain that all of the published information on the biology of "*E. guaza*" in the Mediterranean applies only to the species here recognized as *E. marginatus*.

In Tunisian waters, Bouain et al. (1983) found that females were mature at 44 to 53 cm total length (estimated age 6 to 8 years); and the smallest mature male was 85 cm total length (estimated to be 16 years old). Chauvet (1988) calculated the following growth equation for the Tunisian population:

$LT_t = 114.49(1\text{-}e^{-0.093(t+0.075)})$ where LT_t is total length in millimetre.

Extrapolating from the graph of this equation, he estimated a theoretical maximum age of 35 years for a fish of 118 cm total length. Chauvet (1988) also determined that females become mature at 5 years of age (38 to 58 cm total length) and change sex between ages 9 and 16 (68 to 90 cm total length).

Size: Maximum size 120 cm total length and 35 kg (for Tunisian fish, according to Bouain et al., 1983). In Brazilian waters, ***E. marginatus*** is reported to attain 60 kg (Figueiredo and Menezes, 1980).

Interest to Fisheries: This species is of considerable importance to sport and commercial fisheries in South Africa, and it appears to be one of the most common species of groupers in Mediterranean markets. Landings for the years 1976-1982 in Portugal and several Mediterranean countries were given by Bruslé (1985). It is also common in the markets of Madeira and Rio de Janeiro, and of major commercial importance along the southeast coast of Brazil. Groupers are generally among the highest priced fishes in markets, and ***E. marginatus*** is no exception.

Local names: BRAZIL: Garoupa, Garoupa-verdadeira; ITALY: Cernia bruna; COTE-D'IVOIRE: Awro; MAURITANIA: Madeija; PORTUGAL (including the Azores and Madeira): Mero; SENEGAL: Dialakh, Kotj; SOUTH AFRICA: Yellowbelly rockcod; TUNISIA: Mérou rouge.

Literature: Probably most of the literature published on "***Epinephelus guaza***" of the Mediterranean applies to this species (but see "Remarks" below). Good illustrations were published by Tortonese (1975: colour photograph), Séret (1981: monochrome painting by P. Opic), Maigret and Ly (1986: colour photograph) and Saldanha (1979: monochrome photographs 100 to 105). Bruslé (1985) summarized the biological and fisheries literature on "***Epinephelus guaza***." Randall and Heemstra (1991) included this species in their revision of the Indo-Pacific groupers.

Remarks: A detailed explanation of the nomenclatural confusion involving ***E. marginatus*** is given by Heemstra (1991). A summary of this exposition is given here in order to justify the change in name of this well known and commercially important species. Jordan and Evermann (1896), in their influential and comprehensive work, *The Fishes of North and Middle America*, were the first to use the Linnaean name ***E. guaza*** [sic] for the species that currently bears this name. Previously, the species had been identified as ***Serranus gigas*** (Brünnich, 1768) by Valenciennes (1828), Günther (1859) and Steindachner (1877) or ***Cerna gigas*** by Doderlein, 1882 or ***Epinephelus gigas*** by Jordan and Swain (1885), Jordan and Eigenmann (1890), Boulenger (1895) etc.; or it was described as a new species (***Serranus marginatus*** Lowe, 1834 and ***Epinephelus brachysoma*** Cope, 1871). After Jordan and Evermann's (1896) publication, ***E. marginatus*** and ***E. haifensis*** were confused under the names ***E. guaza*** or ***E. gigas***.

Unfortunately, the species name "***Epinephelus guaza***" (originally ***Labrus Gvaza*** Linnaeus, 1758) cannot be used for this well-known species, because the original description clearly applies to a species of the genus ***Mycteroperca*** from the coast of Venezuela. Linnaeus's description of ***Labrus Gvaza*** (1758:285) was taken verbatim from the travel diary of his student Pehr Löfling (spelt "Loefling" on the title page). This diary was published in 1758, two years after the death of Löfling and in the same year as the tenth edition of Linnaeus's *Systema Naturae*. Löfling spent two years in Spain waiting for the Spanish to organize the expedition to South America in which he was to participate (Wheeler, 1980). While he was in Spain, Löfling collected plants and animals, recording descriptions of the various species in his travel diary. In South America, Löfling added descriptions of more plants and animals to his journal, but he died not long after his arrival. In the published version of this diary (Loefling, 1758) the page with the description of ***Labrus guaza*** is headed with the rubric "CUMANA," which is the name of a port on the Caribbean coast of Venezuela; and all of the animals described on this page are from this locality. Although most of the species descriptions by Löfling that were incorporated in the *Systema Nature* (indicated by the reference "*Loefl. epist.*") are of plants and animals that he observed in Spain, that of ***Labrus guaza*** is clearly not from Spain. For some reason or perhaps as an oversight, Linnaeus gave as the type-locality of this species "in pelago," rather than the more explicit mention of Cumana or South America or the Caribbean.

The original description of ***Labrus Gvaza***, as given by Linnaeus (1758) is typically brief:

> "*L.* [*Labrus*] ***fuscus***, *cauda rotundata, radiis caudatus membranam superantibus. Loefl. epist.* D.11/27. P.16. V.6. A.13. C.15. Habitat in Pelago." ("Dusky ***Labrus***, caudal fin rounded, the rays projecting past the membrane. Dorsal fin with 27 rays, of which the first 11 are spines and the last 16 soft-rays; pectoral-fin rays 16; pelvic-fin rays 6 [i.e., I,5]; anal fin with 13 rays [= 3 spines + 10 soft-rays]. Habitat: in the open ocean.")

This description does not fit the well-known amphi-Atlantic/Mediterranean dusky grouper that is commonly identified as ***Epinephelus guaza***. In fact, it cannot apply to any species of ***Epinephelus***, as they all have 7 to 9 anal-fin rays (one specimen of 29 ***E. morio*** that were counted has 10 anal-fin rays), and no ***Epinephelus*** species has the caudal-fin rays projecting beyond the membrane. The description does, however, fit ***Mycteroperca cidi*** Cervigón, 1966, ***M. interstitialis*** (Poey, 1860), and ***M. phenax*** Jordan and Swain, 1885; and these three species are common in the vicinity of Cumana (the type locality given by Löfling for ***Labrus guaza***). Since the description could apply to any one of these three species of ***Mycteroperca*** and there is no extant type-specimen, the name ***Labrus gvaza*** Linnaeus must be considered a doubtful name (*nomen dubium*) and is thus not available as the valid name of any species.

In the literature on Mediterranean and eastern Atlantic groupers, two similar species (the dusky grouper, ***E. marginatus***, and the Haifa grouper, ***E. haifensis***) have been confused under the names ***Epinephelus*** (or ***Serranus***) ***guaza*** or ***gigas***. ***E. marginatus*** differs in having 8 anal-fin rays (9 in ***E. haifensis***), more elongate body (depth 2.6 to 3.1 versus 2.4 to 2.8 times in standard length), pelvic fins distinctly shorter than pectoral fins and not reaching the anus (pelvic fins subequal to pectoral fins and reaching to or beyond anus in ***E. haifensis*** less than 30 cm standard length), 17 to 19 pectoral-fin rays (18 to 21 in ***E. haifensis***), and the head and body usually showing irregular pale blotches (no pale blotches in ***E. haifensis***).

Of the eastern Atlantic groupers, ***E. marginatus*** is most similar to ***E. goreensis*** and ***E. haifensis***. See the Key to Eastern Atlantic Groupers (above) for differences that will distinguish these species. In the western Indian Ocean, ***E. marginatus*** is most likely to be confused with ***E. chabaudi***, which has 9 anal-fin rays and does not show the irregular pale blotches that are usually visible on ***E. marginatus***; also, ***E. chabaudi*** is usually pinkish grey ventrally (rather than yellowish, the usual colour for ***E. marginatus***).

Epinephelus melanostigma Schultz, 1953

Fig. 355; Pl. XVIIIC

SERRAN Epin 39

Epinephelus melanostigma Schultz, 1953:331, 348, fig. 54 (type locality: Swains Island, Samoa Islands).

Synonyms: None.

FAO Names: **En** - One-blotch grouper; **Fr** - Mérou dossard; **Sp** - Mero espaldaron.

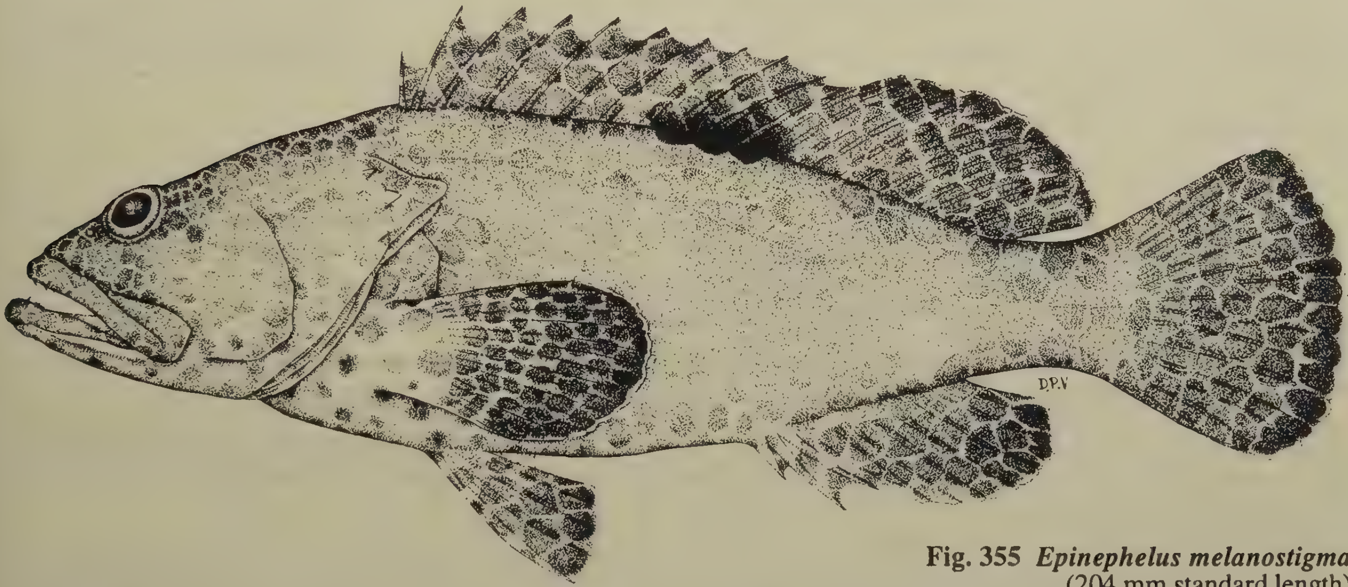


Fig. 355 ***Epinephelus melanostigma***
(204 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.4 times in standard length (for fish 10 to 27 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area flat or slightly concave; preopercle rounded, the serrae mostly covered by skin; upper edge of operculum straight or slightly convex; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 3 to 5 rows of teeth, the inner teeth about twice as long as the outer ones. Gill rakers 7 to 10 on upper limb, 16 to 19 on lower limb. Dorsal fin with XI spines and 14 to 16 rays, the third to tenth spines subequal, the fourth spine 2.8 to 3.8 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays, the second spine less than or subequal to third spine, length of second spine contained 2.6 to 3.6 times in head length and usually less than depth of caudal peduncle; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.2 times in head length; pelvic-fin length 2.0 to 2.6 times in head length; caudal-peduncle depth contained 3.2 to 3.8 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 56 to 68; lateral-scale series 83 to 99. **Colour**: Head, body, and fins covered with close-set dark brown spots, the pale interspaces forming a network pattern; spots on ventral parts of head and body are reddish brown and not so closely set; spots on head progressively smaller anteriorly; a prominent black blotch on body at base of last 4 dorsal-fin spines and extending onto fin at least halfway to margin; no other black blotches at base of dorsal fin or on caudal peduncle; median and pectoral fins with narrow white edge.

Geographical Distribution: Indo-West Pacific from South Africa (Natal) to the central Pacific, including, Mozambique, Mauritius, Indonesia, Philippines, Hong Kong, Taiwan, Okinawa, Papua New Guinea (Bougainville), Solomon Islands, Palau, Caroline Islands, Gilbert Islands, Samoa, Phoenix Islands, Baker, Howland, Cook Islands, and Line Islands (Fig. 356). The apparent absence of *E. melanostigma* at intermediate localities may be a result of confusion with similar species (e.g., *E. tauvina*). Paxton et al. (1989) recorded the species from Australia, but we have not seen any material from there. Not known from the Red Sea or Persian Gulf.

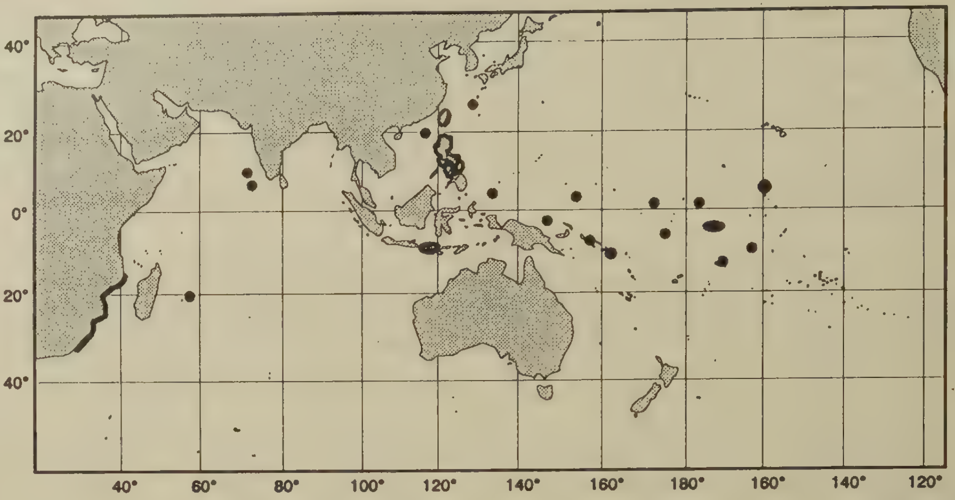


Fig. 356

Habitat and Biology: *E. melanostigma* is a coral-reef species that is known only from depths less than 7 m. However, the specimen illustrated by Gloerfelt-Tarp and Kailola (1984) was taken in a trawl, and it was presumably caught somewhat deeper than 7 m.

Size: Maximum size known is 33 cm total length.

Interest to Fisheries: Because of its small size and apparent rarity, *E. melanostigma* is of little or no commercial importance.

Local Names: JAPAN: Sumitsukihata.

Literature: Randall and Heemstra (1991).

Remarks: *E. melanostigma* is one of the "reticulated groupers", which comprise 9 shallow-water coral-reef species that have a rounded caudal fin and close-set dark brown spots, with the pale interspaces forming a network on the body. These species have been much confused in the literature, and many museum specimens have been misidentified; the other reticulated groupers differ from *E. melanostigma* as follows:

E. bilobatus has 3 large bilobed dark blotches or close-set pairs of dark brown spots on body and base of dorsal fin, dorsal-fin rays 17 or 18, lateral-line scales 48 to 52, and lower gill rakers 14 to 16.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), dorsal-fin rays 16 to 18, length of second anal-fin spine contained 3.6 to 4.3 times in head length, and sides of lower jaw with 2 rows of teeth.

E. hexagonatus has conspicuous white dots on the body between the dark spots, fifth to ninth dorsal-fin spines subequal (length contained 2.5 to 2.8 times in head length), head length contained 2.5 to 2.6 times in standard length, length of second anal-fin spine contained 2.1 to 2.5 times in head length and distinctly longer than third spine or depth of caudal peduncle.

E. macrospilos has the lateral-body scales mostly smooth, lateral-line scales 48 to 52, and no large black blotch at middle of dorsal-fin base.

E. maculatus has the dorsal-fin membranes not incised between the spines; third or fourth dorsal-fin spine longest, its length contained 2.1 to 2.6 times in head length and usually longer than dorsal-fin rays.

E. merra has pectoral fins covered with small black spots largely confined to the rays, third to last dorsal-fin spines subequal (the longest contained 2.6 to 2.9 times in head length), and second anal-fin spine subequal to third and much longer than depth of caudal peduncle.

E. quoyanus has the pectoral fins with indistinct dark brown spots, the base with a large semicircular dark brown spot edged posteriorly with white, 2 dark brown bands or blotches linked by bands on sides of chest, dorsal-fin rays 16 to 18, and longest dorsal-fin spine contained 2.4 to 3.0 times in head length.

E. spilotoceps has 3 black saddle blotches at base of dorsal fin and tiny (nostril size) black spots on the snout; caudal-peduncle depth contained 3.5 to 4.1 times in head length and usually less than length of second anal-fin spine, shallow notch in rear edge of preopercle just above the corner, and lateral-line scales 59 to 69.

E. tauvina is similar to *E. melanostigma* in having a black blotch at middle of dorsal-fin base, but the dark spots on the head and body are poorly defined and well separated (distance between spots about equal to their diameter); *E. tauvina* also has 63 to 74 lateral-line scales and 95 to 112 lateral-scale series.

Epinephelus merra Bloch, 1793

Fig. 357; Pl. XVIIID,E

SERRAN Epin 40

Epinephelus merra Bloch, 1793:17, pl. 329 (type locality: Japanese Sea).

Synonyms: None.

FAO Names: **En** - Honeycomb grouper; **Fr** - Mérou gâteau de cire; **Sp** - Mero panal.

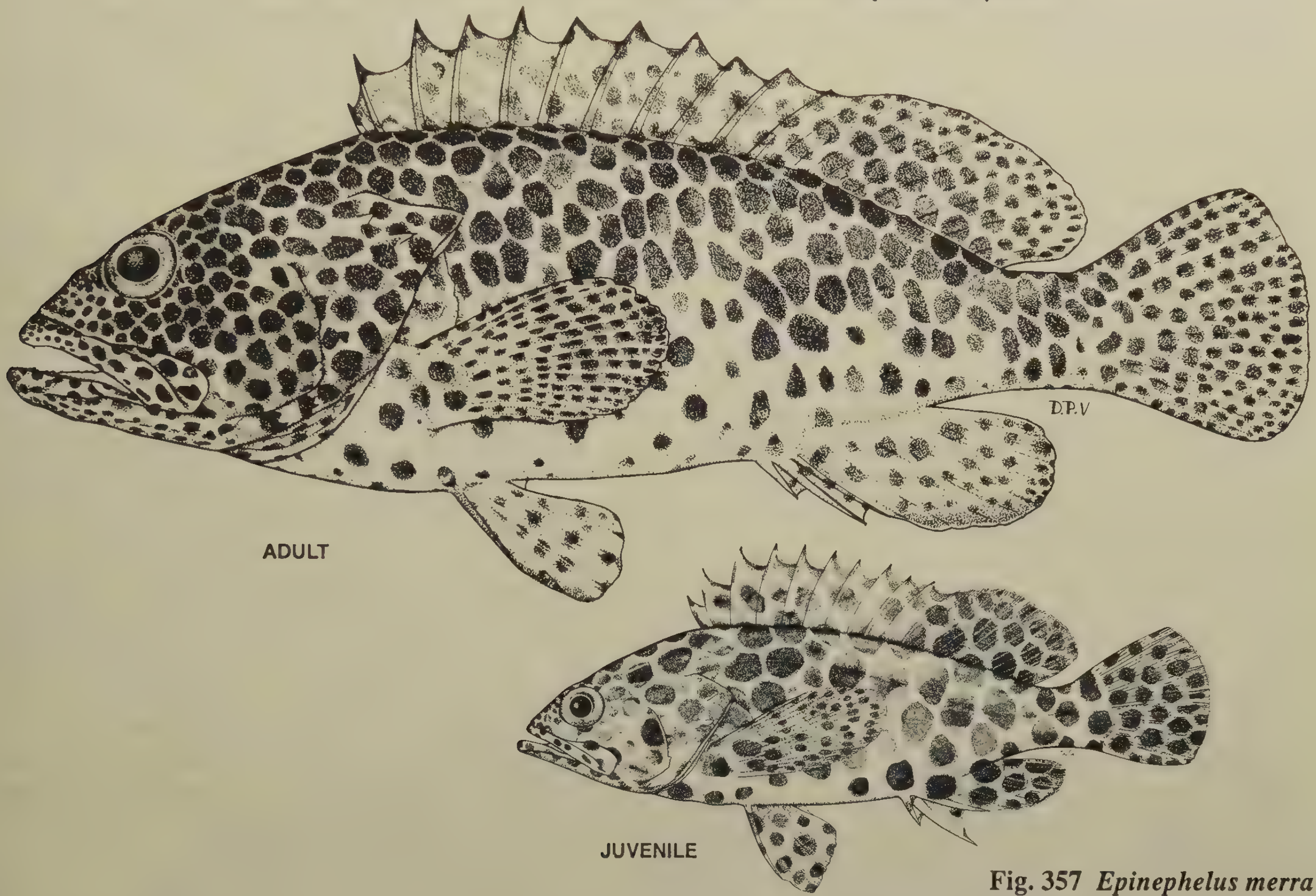


Fig. 357 ***Epinephelus merra***
(adult 170 mm standard length, juvenile 63 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 10 to 22 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat, the dorsal head profile convex; preopercle rounded or subangular, the serrae at angle enlarged; upper edge of operculum almost straight; nostrils subequal or rear nostrils larger; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth, the inner teeth about twice the length of outer ones. Gill rakers 6 to 9 on upper limb, 14 to 17 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the third to last spines subequal, the longest contained 2.4 to 3.2 times in head length; anal fin with III spines and 8 rays, the second spine subequal to the third,its length contained 2.1 to 3.0 times in head length and much longer than depth of peduncle; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic-fin length contained 1.8 to 2.2 times in head length; caudal-peduncle depth contained 3.2 to 4.1 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 54; lateral-scale series 98 to 114. Pyloric caeca 8. **Colour**: Head, body, and fins pale, covered with close-set, dark brown or reddish brown spots, the interspaces forming an irregular pale reticulum; spots on ventral part of body paler, more widely spaced and diffuse in outline; some midlateral spots often joined to form horizontal bands; 5 irregular dark bars can be displayed by differential darkening of some body spots, but black dorsal blotches never present; dark spots on median fins become smaller towards the fin margin; pectoral fins covered with distinct small black spots, largely confined to the rays (the best diagnostic colour character for *E. merra*); tips of interspinous dorsal-fin membranes white or pale yellow, with a small submarginal black spot.

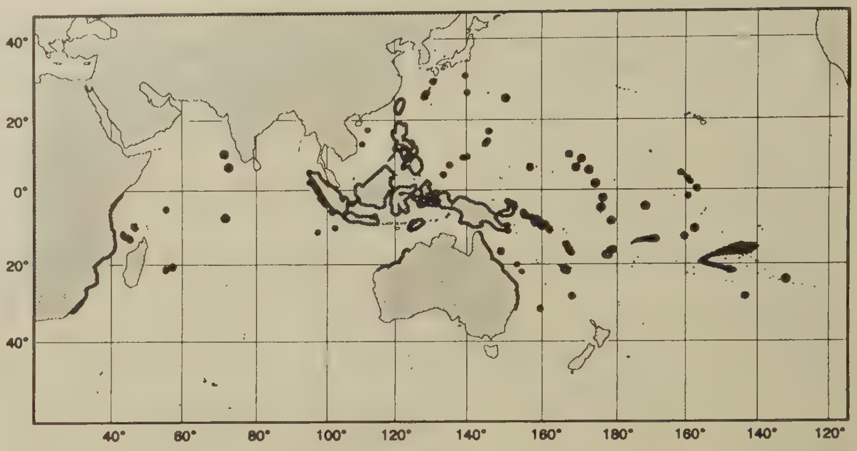


Fig. 358

Geographical Distribution: *E. merra* is widely distributed in the Indo-Pacific region from South Africa to French Polynesia in the central Pacific (Fig. 358). Except in the western Indian Ocean, where it is known (but not common) along the African coast from Kenya to South Africa (juveniles occur south to Port Alfred), *E. merra* seems to be an insular species. It is not known from the Red Sea, Persian Gulf, or Asian mainland. It occurs at most (probably all) of the tropical islands in the Indian Ocean. In the Pacific, it ranges from Japan to Australia (from Western Australia to New South Wales) and Lord Howe Island and eastward to the Tuamotu Archipelago. It occurs at most Pacific islands, both on and off the Pacific Plate, but it is not found at the Hawaiian Islands (although its introduction there has been attempted), Marquesas, Pitcairn Group, or at Easter Island.

Habitat and Biology: *E. merra* is a shallow-water coral reef species and is typically found around patch reefs in lagoons and bays. It is usually seen in depths less than 20 m, but is occasionally found as deep as 50 m. Randall and Brock (1960) found that 68% of the fish with food in their stomach had eaten crustaceans (primarily crabs) and 29% contained fishes. But during periods when postlarval fishes were settling out on the reef, *E. merra* fed mainly on these small fishes. Harmelin-Vivien and Bouchon (1976) determined that juveniles (at Madagascar) fed more on crustaceans (brachyurans, 63% by weight) than on fishes (35%), but in adults these proportions were reversed (22% brachyurans and 68% fishes and 8% cephalopods). This increase of piscivory with age is common in groupers. These authors also found that brachyurans were the most common prey at night, and fishes were taken more often during the day. At Okinawa in Japan, Sano et al. (1984) examined the prey of 12 *E. merra* that contained food; they found a preference for crabs (50%) and blenniid fishes (25%).

Randall (1955) provided evidence that this species is a protogynous hermaphrodite: of 1 067 fish examined, all of the small adults (less than 16 cm standard length) were females; the average size of adult males was 20 cm, and the largest was 25 cm standard length; the mean for adult females was 16 cm, and the largest was 21 cm standard length. The gonads of some fish contained both testicular and ovarian tissue. At the Society Islands, *E. merra* spawn between January and April for 3 or 4 days at the time of the full moon. Like most groupers, this species spends its entire life in one small area. Of 1 000 fish tagged at Moorea, 45 were recovered over a period of two years; except for some fish that were displaced from the capture site, none showed any significant movement from their home reef. A 10 cm marked specimen released on 15 January 1968 at Oahu, Hawaiian Islands, was 24 cm total length when it was recaptured on 14 July 1971.

Size: *E. merra* attains a maximum of 26 cm standard length (about 32 cm total length).

Interest to Fisheries: This species is of importance in artisanal fisheries because of its abundance in shallow water. Caught with handlines, fish traps, and spear.

Local Names: AUSTRALIA: Honeycomb cod, Wire-netting cod; COMORO ISLANDS: Ntsehele; JAPAN: Tammonhata; KENYA: Tewa ndudu, Kivongui (Swahili); MAURITIUS: Vieille Voleuse; NEW CALEDONIA: Loche rayon de miel, Macabit; REUNION: Macabit; SOUTH AFRICA: Honeycomb rockcod; TAHITI: Tarao maraurau, Veve.

Literature: Myers (1989); Randall and Heemstra (1991).

Remarks: *E. merra* is one of the "reticulated groupers," which comprise 9 shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These species have been much confused in the literature, and many museum specimens have been misidentified. *E. merra* can be distinguished from the other reticulated groupers by its pectoral-fin pattern of conspicuous black dots that are largely confined to the rays of the fin. Other differences between *E. merra* and the reticulated groupers are as follows:

E. bilobatus has 3 bilobed dark blotches or close-set pairs of dark brown spots on body and base of dorsal fin, dark spots on median fins not much smaller distally, and dorsal-fin rays 17 or 18.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), longest anal-fin spine contained 3.6 to 4.3 times in head length, dark bands on the chest, and 83 to 98 lateral-scale series.

E. hexagonatus has conspicuous white dots on the body between the dark spots, 4 or 5 brownish black blotches on body at base of dorsal fin, a large olive-brown spot or band just behind eye, and lateral-line scales 61 to 70.

E. macrospilos has the lateral-body scales mostly smooth and the pectoral fins dusky with narrow white edge.

E. maculatus has the interspinous dorsal-fin membranes not incised, third or fourth dorsal-fin spine longest (its length contained 2.1 to 2.6 times in head length and longer than dorsal-fin rays); and juveniles are yellowish brown with irregular white blotches on the body.

E. melanostigma has a large black blotch at base of last 4 dorsal-fin spines, length of second anal-fin spine not longer than caudal-peduncle depth, and lateral-line scales 56 to 68.

E. quoyanus has the pectoral fins with indistinct dark brown spots and the base with a large semicircular dark brown spot edged posteriorly with white, 2 oblique dark brown bands or blotches linked by bands on sides of chest, dorsal-fin rays 16 to 18, and third to fifth dorsal-fin spines longest (length contained 2.4 to 3.0 times in head length).

E. spilotoceps has dark spots on the snout very small (about the size of the nostrils), 3 black blotches at base of dorsal fin and another on top of caudal peduncle, and lateral-line scales 59 to 69.

Epinephelus miliaris (Valenciennes, 1830) Fig. 359; Pl. XVIIIF SERRAN Epin 42

Serranus miliaris Valenciennes in Cuv. and Val., 1830:520 (type locality: Vanikolo, Santa Cruz Islands [*fide* Bauchot et al., 1984]).

Synonyms: ***Serranus Gaimardi*** Valenciennes in Cuv. and Val., 1830:520 (type locality: Vanikolo [*fide* Bauchot et al., 1984]). ***Serranus diktiophorus*** Bleeker, 1856a:38 (type locality: Manado, Sulawesi [Celebes] Indonesia). ***Epinephelus dictiophorus***: Bleeker, 1873-76:65, pl. 284, fig. 3. ***Epinephelus*** sp. Fourmanoir, 1954:214 (Anjouan, Comoro Islands). ***Epinephelus fuscus*** Fourmanoir, 1961:92 (type locality: Comoro Islands, northwest of Madagascar; no holotype designated); Fourmanoir, 1963:140, fig. (a second "original" description, type locality: west coast of Madagascar; holotype, 45 cm [total length] deposited in the Muséum National d'Histoire Naturelle in Paris).

FAO Names: **En** - Netfin grouper (formerly: Honeyfin grouper); **Fr** - Mérou abeille (formerly: Vieille abeille); **Sp** - Mero colmenar.

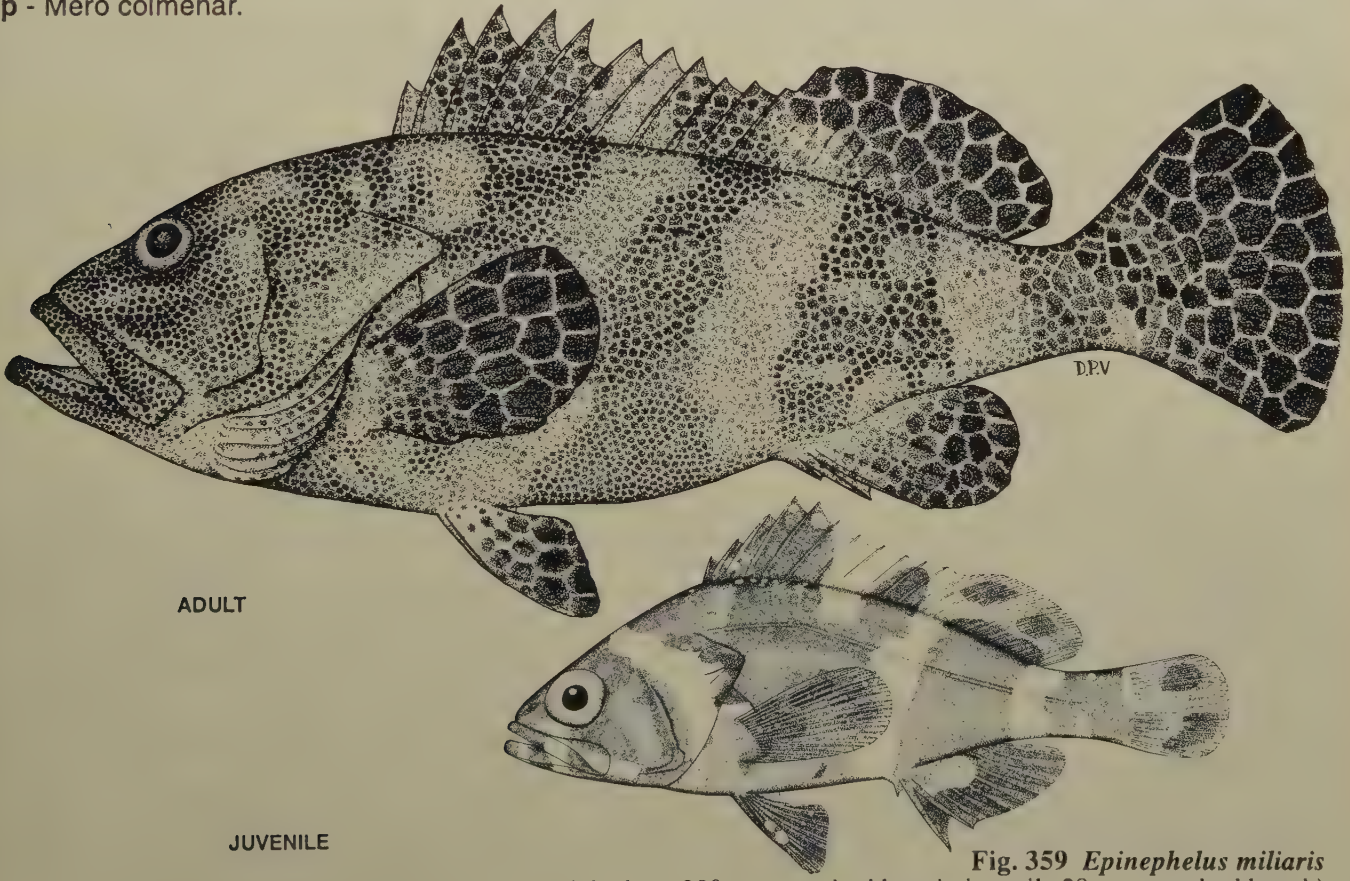


Fig. 359 ***Epinephelus miliaris***
(adult about 300 mm standard length, juvenile 28 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.2 times in standard length (for fish 15 to 43 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital convex, but dorsal head profile with a slight concavity at eyes; preopercle subangular, with a shallow notch just above the angle and the serrae at the angle enlarged in juveniles; upper edge of operculum straight; diameter of posterior nostrils about twice that of anteriors; maxilla reaches vertical at rear edge of eye or thereabouts; adults larger than 25 cm standard length with a low step on lower edge of maxilla at distal expansion; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 8 or 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.2 to 2.7 times in head length and distinctly longer than the longest rays, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays, the third spine usually slightly longer than second, length of second spine contained 3.2 to 4.0 times in head length; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.6 to 1.9 times in head length; pelvic fins reach slightly past anus or not so far, their length contained 1.7 to 2.1 times in head length; caudal fin rounded. Lateral-body scales distinctly ctenoid, with a few auxiliary scales; lateral-line scales 48 to 52; lateral-scale series 92 to 108. Pyloric caeca 30. **Colour**: Head and body pale, covered with small, close-set, polygonal, dark brown, reddish brown, or yellowish brown spots, the ground colour forming a pale, irregular, small-mesh network; fins with pattern similar to the body, but the dark spots are darker and distinctly larger than on the body. Some spots on body and dorsal fin are darker than others, forming 4 or 5 broad, oblique, dark bars (1 on nape, 3 extending into dorsal fin and 1 at base of caudal fin).

Geographical Distribution: *E. miliaris* is known from the western Indian Ocean (but not the Red Sea or Persian Gulf) to the Gilbert Islands and Samoa in the central Pacific. It is an insular species that has been reported from Pemba and Zanzibar (off Tanzania), Bassa da India (in Mozambique Channel), Comoros, Aldabra, Madagascar, Mauritius, Seychelles, Chagos, East Burma Sea, Andaman Islands, Indonesia (Sulawesi [Celebes] only), South China Sea, Ryukyu Islands, New Guinea, New Ireland, New Georgia, Solomon Islands, Santa Cruz Islands, Palau, Caroline Islands, and Fiji (Fig. 360).

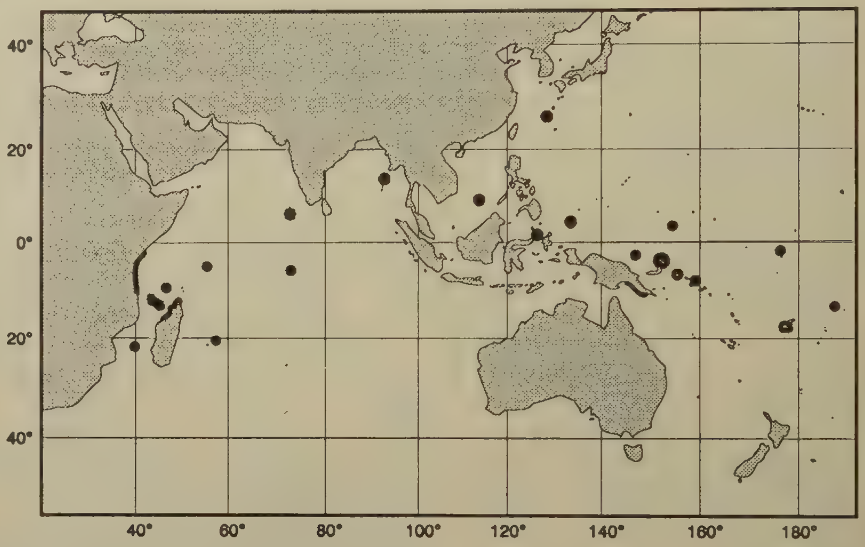


Fig. 360

Habitat and Biology: *E. miliaris* is found in a variety of habitats. Juveniles (8 to 21 cm standard length) have been taken on mud bottom, seagrass beds, mangrove swamps, and from coral reefs in depths of 1 to 16 m. Adults have been caught on coral reefs in depths of 18 to 180 m. Morgans (1982:24, pl. 6 "*Epinephelus dictiophorus*") reported a mature female of 35 cm standard length; stomach contents of 2 fish that he examined included a juvenile clappid crab, a stomatopod, and a gastropod.

Size: Maximum size known to us is 43 cm standard length (53 cm total length).

Interest to Fisheries: Because of its rarity, *E. miliaris* is of minor importance in local fisheries.

Local Names: JAPAN: Hoosekihata-modoki.

Literature: Randall and Heemstra (1991).

Remarks: *E. miliaris* bears some similarity to *E. maculatus* in colour pattern, long dorsal-fin spines, step on lower edge of maxilla, and meristic characters. But *E. maculatus* has the dark spots on the body notably larger than those on *E. miliaris*, and the dark spots on the soft dorsal, caudal, and anal fins are not larger or darker than those on the body; also, the interspinous dorsal-fin membranes of *E. maculatus* are only slightly incised. *E. fuscoguttatus* and *E. polyphekadion*, which might be mistaken for *E. miliaris*, have only 14 or 15 dorsal-fin rays, and the dark spots on the fins are not larger or darker than those on the body.

Fourmanoir (1961, 1963) gave the dorsal-fin ray count as 14 for his holotype of *E. fuscus*, but our examination and a radiograph of this specimen showed that it has 17 dorsal soft-rays, although the second soft-ray has developed into a spine distally.

Epinephelus morio (Valenciennes 1828) Fig. 361; Pl. XIXA SERRAN Epin 18

Serranus Morio Valenciennes in Cuv. and Val., 1828:285 (type locality: New York).

Synonyms: *Serranus erythrogaster* DeKay, 1842:21, pl. 19, fig. 52 (type locality: "New York fish market" [probably caught south of Virginia]). ?*Serranus luridus* Ranzani, 1842:20, pl. 8, fig. 1 (type locality: Brazil). *Serranus remotus* Poey, 1860:140 (type locality: Cuba). *Serranus angustifrons* Steindachner, 1864:230, pl. 7, figs 2,3 (type locality: Cuba).

FAO Names: **En** - Red grouper; **Fr** - Mérou rouge; **Sp** - Mero americano (also: Garaupa).

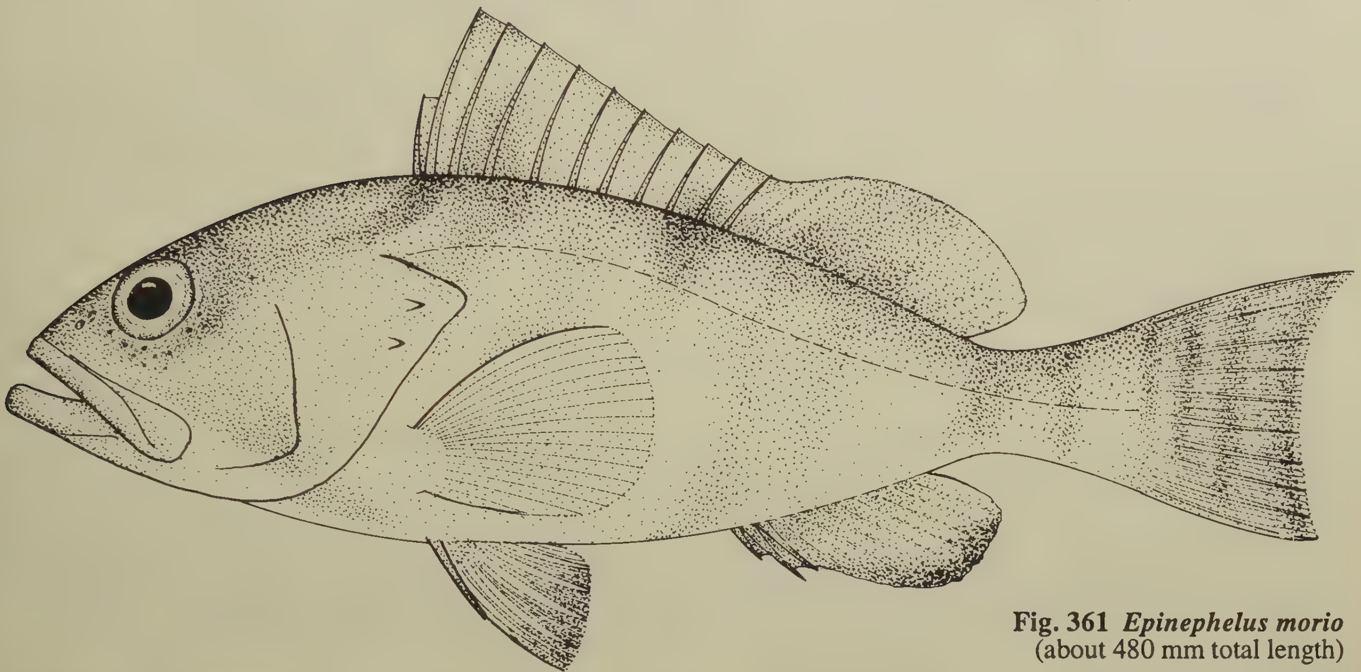


Fig. 361 *Epinephelus morio*
(about 480 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 3.0 times in standard length (for fish 13 to 26 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital convex; preopercle subangular, the serrae at angle slightly enlarged; upper edge of operculum straight; nostrils subequal. Gill rakers 8 or 9 on upper limb and 15 or 16 on lower limb, total 23 to 25. Dorsal fin with XI spines and 16 or 17 rays, the membrane not incised between the spines and the second spine longest, giving the fin a triangular sail-like aspect; anal fin with III spines and 8 to 10 rays; pectoral-fin rays 16 to 18; caudal fin convex in fish less than 15 cm standard length, truncate or slightly concave in larger fish. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 60 to 68; lateral-scale series 112 to 128. **Colour**: Head and body dark reddish brown, shading to pink or reddish below; soft dorsal, caudal, and anal fins dark distally with a narrow white edge; a few dark dots on snout and/or cheeks; body often with irregular white spots and/or large pale blotches.

Geographical Distribution: Western Atlantic from North Carolina to southern Brazil, including the Gulf of Mexico, Caribbean, and Bermuda; strays occur north to Massachusetts (Fig. 362).

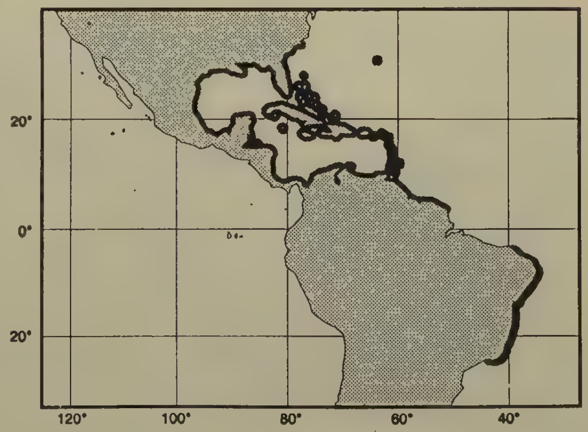


Fig. 362

Habitat and Biology: Moe (1969) has published a comprehensive study of the age, growth, and biology of this species in the Gulf of Mexico. Juveniles of 3 to 20 cm standard length are occasionally found on shallow seagrass beds and inshore reefs. Larger juveniles (20 to 40 cm standard length) are commonly found in crevices and under ledges on rocky reef bottom in depths of 5 to 25 m. At 40 to 50 cm standard length and 4 to 6 years of age, females become mature and begin to migrate to deeper water (50 to 300 m) where they also occur over sandy or mud bottom. Most females transform to males between ages 7 and 14. Maximum age attained is at least 25 years. The von Bertalanffy growth equation $L_t = 672(1-e^{-0.179(t+0.449)})$ agrees well with empirical data and back calculations of body length. The weight/length function given by Bullock and Smith (1991) and based on Moe's (1969) data is $W = 5.42 \times 10^{-8}\ L^{2.897}$ where W is weight in grammes and L is standard length in millimetre.

The eastern Gulf of Mexico population spawns during April and May (Moe, 1969). Fecundity ranged from 312 000 to 5 735 700 eggs per female. Eggs are pelagic, less than 1.0 mm in diameter, contain a single oil droplet, and lack filaments or other appendages. At about 20 mm standard length, the pelagic postlarvae transform to the benthic juvenile stage.

Adults feed on a wide variety of fishes and invertebrates. Red grouper are particularly susceptible to the toxin of red tide (*Ptychodiscus brevi*) blooms, and in 1971 the species was exterminated on reefs in 12 to 15 m off Sarasota Florida (Bullock and Smith, 1991).

Size: Attains at least 90 cm total length. As of 1990, the International Game Fish Association lists the all-tackle record for *E. morio* as 14.74 kg for a fish caught off Port Canaveral, Florida.

Interest to Fisheries: *E. morio* is one of the two most important species of the commercial reef fishes caught off the coast of Florida (Bullock and Smith, 1991). On the Campeche Bank off the Yucatan Peninsula, red grouper made up 90% of the total catch of the Cuban otter trawl fisheries. The catch in this area has declined from a peak in 1975 of 54.7 thousand metric tons (TMT) to a low of 2.0 TMT in 1979 (Valdes and Padron, 1980). See Arreguin-Sanchez (1987) for recent information on the Campeche Bank fishery. Red grouper are the most common commercial species in the Isla de Margarita region of Venezuela (Cervigón, 1966). The species is caught with hook-and-line, bottom set longlines, traps, and trawls.

Local Names: BRAZIL: Garoupa-de-São Tomé; MEXICO: Cherna americana, Cherna de vivero; VENEZUELA: Mero paracamo.

Literature: C.L. Smith (1971); Bauchot et al. (1984); Frias (1982); Gonsales (1982); Figueiredo and Menezes (1980).

Remarks: *Serranus luridus* Ranzani was listed as a synonym of *E. adscensionis* by Smith (1971), but neither the original description (Ranzani, 1842:20, no mention of dark spots) nor the illustration (pl. 8, fig. 1, showing a uniformly coloured fish with an emarginate caudal fin) fit *E. adscensionis*. Except for the slightly low dorsal-fin ray count (15) given by Ranzani, the description and illustration fit *E. morio*. The lack of spots or distinctive dark markings and the combination of truncate caudal fin, long second dorsal-fin spine, and the anal-fin count of 9 rays rule out all other western Atlantic species of *Epinephelus*. The pallid ("*luridus*") condition of Ranzani's fish was probably simply the result of its being a preserved specimen.

Epinephelus morrhua (Valenciennes, 1833) Fig. 363; Pl. XIXB SERRAN Epin 44

Serranus morrhua Valenciennes in Cuv. and Val., 1833:434 (type locality: Mauritius).

Synonyms: *Epinephelus cometae* Tanaka, 1927:704, pl. 149, fig. 447 (type locality: Tanabe, Wakayama Prefecture, Japan).

FAO Names: **En** - Comet grouper; **Fr** - Mérou comète; **Sp** - Mero cometa.

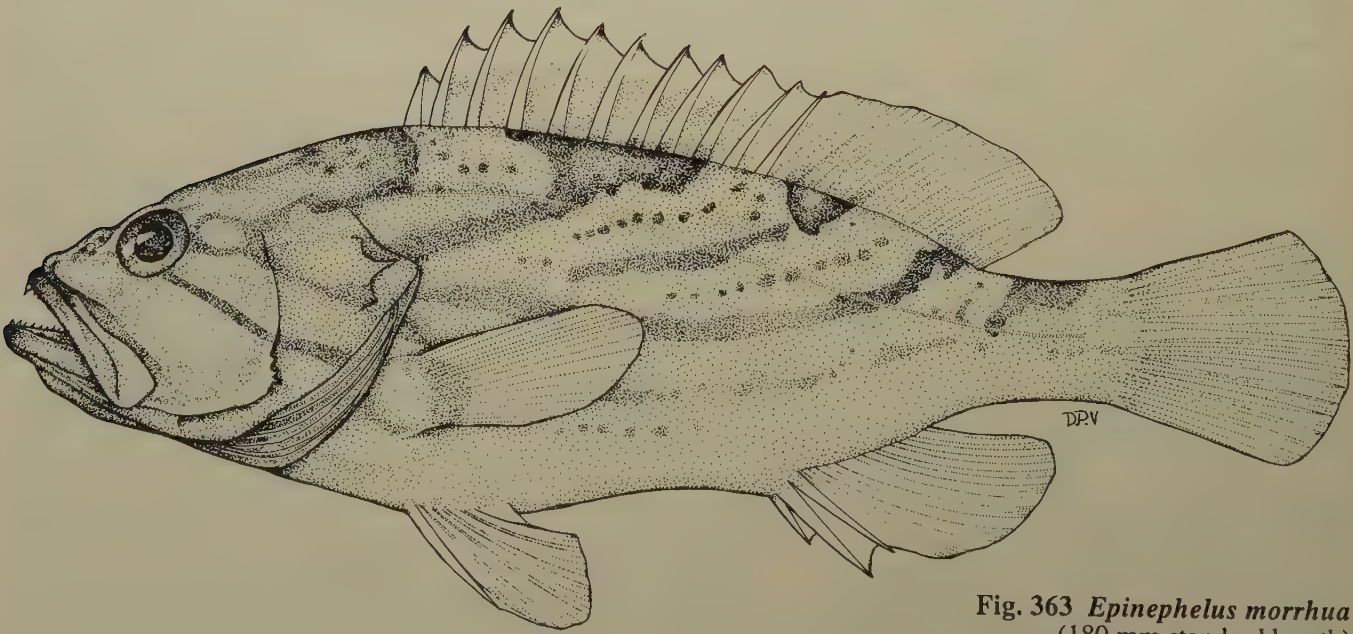


Fig. 363 *Epinephelus morrhua*
(180 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.1 times in standard length (for fish 13 to 61 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat to moderately convex, the dorsal head profile slightly convex; preopercle with a shallow indentation just above the enlarged serrae at the corner; upper edge of operculum almost straight; adults with posterior nostril diameter 2 or 3 times larger than anterior nostril; maxilla reaches to or past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 18 on lower limb, the longest gill rakers shorter than longest gill filaments. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.6 to 3.3 times in head length and about equal to longest dorsal-fin ray; anal fin with III spines and 7 or 8 rays, the second and third spines subequal; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.8 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.7 times in head length; caudal fin convex to moderately rounded. Lateral-body scales distinctly ctenoid, occasionally with a few auxiliary scales; lateral-line scales 55 to 64; lateral-scale series 108 to 125. **Colour**: Head and body buff, with dark brown bands as follows: a bifurcate band begins at rear edge of eye, the upper branch extending to a dark brown saddle blotch on nape just in front of dorsal fin, the lower branch running to lower opercular spine and continuing on body as a midlateral band that bifurcates above the pectoral fin, the upper branch running to a dark blotch at base of third to seventh dorsal-fin rays, the lower branch curving up to base of last 4 dorsal-fin rays; another dark band from upper edge of operculum to base of fifth to ninth dorsal-fin spines; narrow band from lower edge of eye to pectoral-fin base, continued as a broken band along lower part of body and curving up to dorsal part of peduncle; broad band from maxillary groove to rear end of interopercle. Small dark brown spots often present in pale areas between bands and usually arranged in series paralleling the bands; fins generally unmarked; pectoral fins hyaline yellow. In juveniles, the dark bands appear first as series of dark blotches.

Geographical Distribution: *E. morrhua* ranges from the Red Sea and western Indian Ocean to the central Pacific Ocean. We examined specimens or verified records from the Sinai Peninsula, Quseir, Jeddah, Djibouti, Zanzibar, Tanzania, Mozambique, South Africa (Natal), Comoros, Aldabra, Madagascar, Mauritius, Réunion, Chagos, Andaman Sea, Indonesia, Viet Nam, Philippines, Hong Kong, southern Japan, Ogasawara Islands, Mariana Islands, Palau, Guam, Papua New Guinea, Australia (Northern Territory to northern New South Wales), New Ireland, New Caledonia, Rotuma, Fiji, and the Cook Islands (Fig. 364).

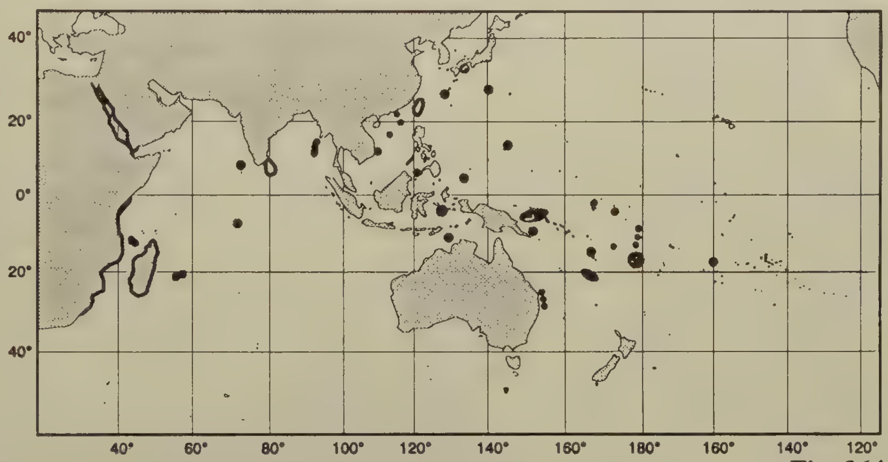


Fig. 364

Habitat and Biology: *E. morrhua* is a deep-water species that is usually found in depths of 80 to 370 m. Morgans (1982) reported a 46 cm standard length, 3.6 kg, mature male (as "*Epinephelus cometae*") from north of Zanzibar Island.

Size: Attains at least 61 cm standard length (73 cm total length) and 5 kg; Fourmanoir and Laboute (1976) gave the maximum total length for *E. morrhua* as 90 cm.

Interest to Fisheries: An excellent food fish, but not common in local markets (probably because of its deep-water habitat). Said to be dangerous (because of ciguatera) at Mauritius (Postel, et al., 1963). Caught with hand-line, longlines, and gill nets.

Local Names: HONG KONG: Yau-paan; JAPAN: Hôkihata; NEW CALEDONIA: Loche à bandes noires; REUNION: Cabot noir; SRI LANKA: Kallu kaleva.

Literature: Randall and Klausewitz (1986); Randall and Heemstra (1991).

Remarks: The Persian Gulf records for *E. morrhua* and *E. radiatus* that were shown on the distribution map of Randall and Klausewitz (1986) should have been placed in the Gulf of Oman instead of in the Persian Gulf.

E. morrhua is one of 4 deep-water groupers that are characterized by having the body depth distinctly less than head length, 2 to 5 distinctly enlarged serrae at corner of preopercle, 2 rows of teeth at sides of lower jaw, dorsal-fin rays 13 to 15, pectoral fins not fleshy, pelvic-fin length contained 2.0 to 2.8 times in head length, lateral-line scales 54 to 66, no auxiliary scales on body, and the colour pattern dominated by curving dark bands or longitudinal series of dark spots. The other 3 species of this *E. morrhua* species-complex are *E. poecilonotus*, *E. radiatus* and *E. tuamotuensis*. These 4 species have often been confused, and we can find no meristic or morphological characters that will distinguish them.

Juveniles of *E. poecilonotus* have a large dark brown or black saddle blotch on body at base of spinous dorsal fin; this blotch is isolated from other dark bands on the body and extends over front half of spinous dorsal fin; in adults this blotch breaks up into small dark spots, as do the dark bands on the body, and in large adults most of the dark spots and bands have disappeared; juveniles with a dark band from eye to lower opercular spine, continued as a dark curving midlateral stripe or series of spots to a dark saddle blotch on peduncle. On adults, the triangular interspinous dorsal-fin margins are brownish yellow or gold. J.L.B. Smith (1958) confused *E. morrhua* with *E. poecilonotus*; his fig. A is of a 33 cm total length *E. morrhua* from Mozambique and his fig. B is a 55 cm total length *E. poecilonotus* from Kenya.

Juveniles of *E. radiatus* have 5 irregular, solid, dark brown bands (with age only the edges remain dark) that run down and forward from dorsal edge of body, the first from nape to eye, the second from base of middle dorsal-fin spines to upper end of gill opening, the third and fourth dark bands from anterior and posterior dorsal-fin rays, both branching as they pass ventrally, and the last dark band on caudal peduncle; with growth, the dark bands break into spots and disappear ventrally on adults; soft dorsal fin and dorsal part of caudal fin densely spotted.

E. tuamotuensis has the dark bands on head and body forming a coarse reticulum that does not extend to ventral part of body.

Epinephelus multinotatus (Peters, 1876) Fig. 365; Pl. XIXC,D SERRAN Epin 45

Serranus multinotatus Peters, 1876:435 (type locality: Mauritius).

Synonyms: *Serranus jayakari* Boulenger, 1889:237 (type locality: Muscat, Oman). *Epinephelus rankini* Whitley, 1945:24 (type locality: Onslow, Western Australia). *Epinephelus* sp. Fourmanoir, 1954:216, pl. 6, fig. 2 (Comoro Islands). *Epinephelus leprosus* Smith, 1955:310, pl. 1A (type locality: Aldabra, Seychelles).

FAO Names: **En** - White-blotched grouper; **Fr** - Mérou plate grise (formerly: Vielle plate grise); **Sp** - Mero de lunares.

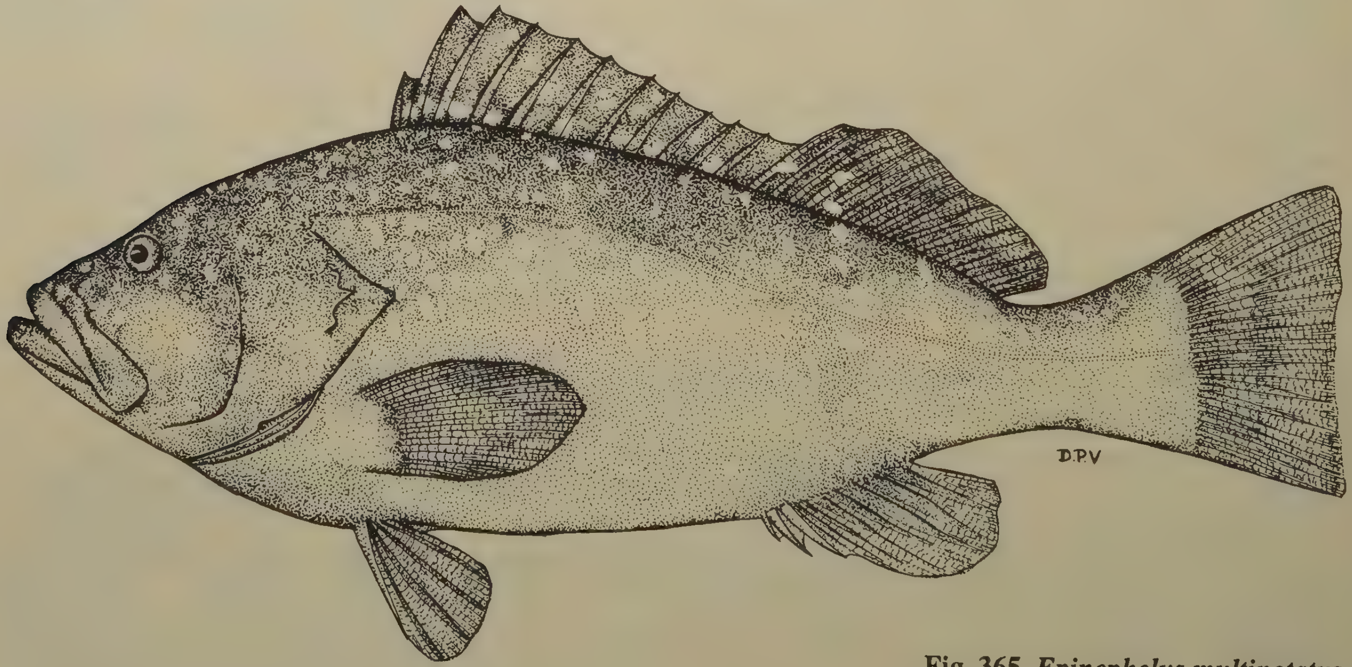


Fig. 365 *Epinephelus multinotatus*
(519 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 2.9 times in standard length (for fish 11 to 63 cm standard length). Head length contained 2.4 to 2.7 times in standard length; interorbital area distinctly convex, the dorsal head profile slightly convex; preopercle subangular, with a shallow notch (more distinct in adults) just above the angle, the serrae at angle not or only slightly enlarged; upper edge of operculum straight or nearly so; posterior nostrils of adults about twice the size of anterior nostrils; maxilla reaches vertical at rear edge of eye or thereabouts; ventral edge of maxilla of adults with distinct step distally; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 9 to 11 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and

15 to 17 rays, the third or fourth spine longest, its length contained 2.3 to 2.9 times in head length, the interspinous membranes not incised, the anterior rays distinctly longer than last spine; anal fin with III spines and 8 rays, the third spine clearly longer than the second, length of third spine contained 3.4 to 4.6 times in head length and less than or subequal to peduncle depth; pectoral-fin rays 18 to 20; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.7 to 2.3 times in head length; pelvic fins not reaching anus; caudal fin truncate to slightly emarginate. Lateral-body scales distinctly ctenoid, with numerous auxiliary scales; lateral-line scales 64 to 81; lateral-scale series 130 to 162. **Colour**: Head and body of live or fresh fish dark purplish grey, with scattered irregular whitish spots and blotches which are faint or absent on preserved fish; pelvic fins greyish black; rear margins of median fins with narrow white edge. Specimens from the western Indian Ocean (except the Persian Gulf and Gulf of Oman) usually have numerous small dark reddish brown spots over the ventral parts of the head and body. Juveniles (4 to 7 cm standard length) from the Persian Gulf are dark greyish blue with caudal fin, peduncle, soft dorsal, and rear part of anal fin yellow; pelvic fins and ventral margin of anal fin blackish.

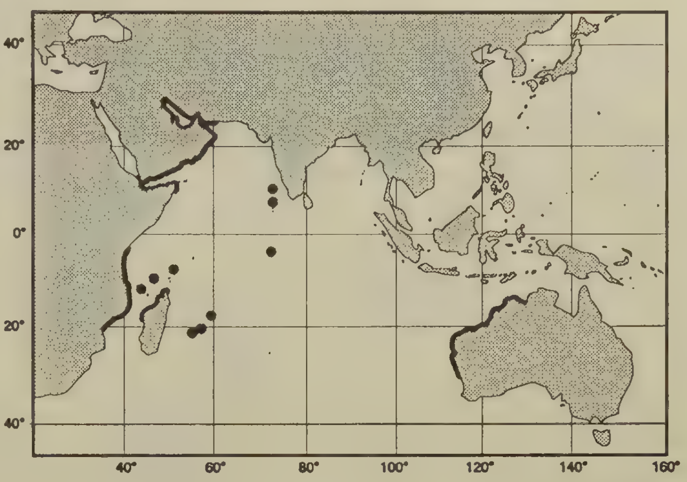


Fig. 366

Geographical Distribution: ***E. multinotatus*** is known only from the Indian Ocean (but not the Red Sea). We have examined specimens from Zanzibar, southern Mozambique, Madagascar, Mauritius, Réunion, St. Brandon's Shoals, Seychelles, Persian Gulf, Gulf of Oman, and Western Australia (from Monte Bello Islands to Shark Bay). Literature records include Tanzania (Mafia and Pemba islands), Kenya, Comoros, Chagos, and the Maldive Islands (Fig. 366).

Habitat and Biology: Juveniles are found on inshore coral reefs, and adults are more common in deeper water (to depths of 90 m). Morgans (1982) reported that females (identified as "*E. leprosus*") were mature at 50 cm standard length (3.6 kg) and possibly at smaller size; stomach contents of 3 fish consisted of small fishes and crabs. The colour pattern of juveniles in the Persian Gulf (see above) is remarkably similar to that of the damselfish *Neopomacentrus sindensis* (Day), which occurs from the Persian Gulf to Pakistan. Nigel Downing (pers. comm.) has suggested that the juveniles of ***E. multinotatus*** may be a mimic of *N. sindensis*. When it gets larger than the damselfish, it develops whitish spots on the body and begins to lose its yellow coloration. The basis for this mimicry, like that of hamlets (*Hypoplectrus* spp.) mimicking damselfishes in the Caribbean (Randall and Randall, 1960; Thresher, 1978), would seem to be that the grouper, in the guise of a herbivorous pomacentrid, is enabled to get closer to its unsuspecting prey.

Size: According to Allen and Swainston (1988), ***E. multinotatus*** attains a total length of 100 cm and a weight of 9 kg.

Interest to Fisheries: Probably of some commercial importance in local fisheries. Caught with hook-and-line and traps.

Local Names: AUSTRALIA: White-blotched rockcod.

Literature: Randall and Heemstra (1991).

Remarks: Based on colour pattern and scale counts, ***E. multinotatus*** appears to have differentiated into 3 separate populations: 1) Western Indian Ocean (east coast of Africa, Comoros, Madagascar, Seychelles, Mauritius, Réunion, St. Brandon Shoals, and Chagos Archipelago); 2) Persian Gulf and Gulf of Oman; and 3) Western Australia. The population in the western Indian Ocean has small dark brown spots on the lower parts of the head and body, but these dark spots are absent in the populations in the gulfs and Western Australia. Australian specimens seem to have higher scale counts (lateral line 71 to 81, lateral-scale series 137 to 162, n = 5) than in the populations in the western Indian Ocean and gulfs (lateral line 62 to 77, lateral-scale series 130 to 151, n = 32).

E. multinotatus is closely related to ***E. flavocaeruleus*** of the Indian Ocean and ***E. cyanopodus*** of the Pacific. These 3 species share the same meristic and morphometric features, fin configurations and ctenoid scales; they are distinguished primarily by differences in colour patterns. The colour pattern of juveniles of ***E. multinotatus***, at least in the Persian Gulf, is similar to that of ***E. flavocaeruleus*** juveniles; this led Randall and Whitehead (1985) to misidentify a 46 mm standard length ***E. multinotatus*** from the gulf as ***E. flavocaeruleus***.

Epinephelus mystacinus (Poey, 1852)

Fig. 367; Pl. XIXE

SERRAN Epin 19

Serranus mystacinus Poey, 1852:52, pl. 10, fig. 1 (type locality: Cuba).

Synonyms: None.

FAO Names: **En** - Misty grouper; **Fr** - Mérou brouillard; **Sp** - Mero listado.

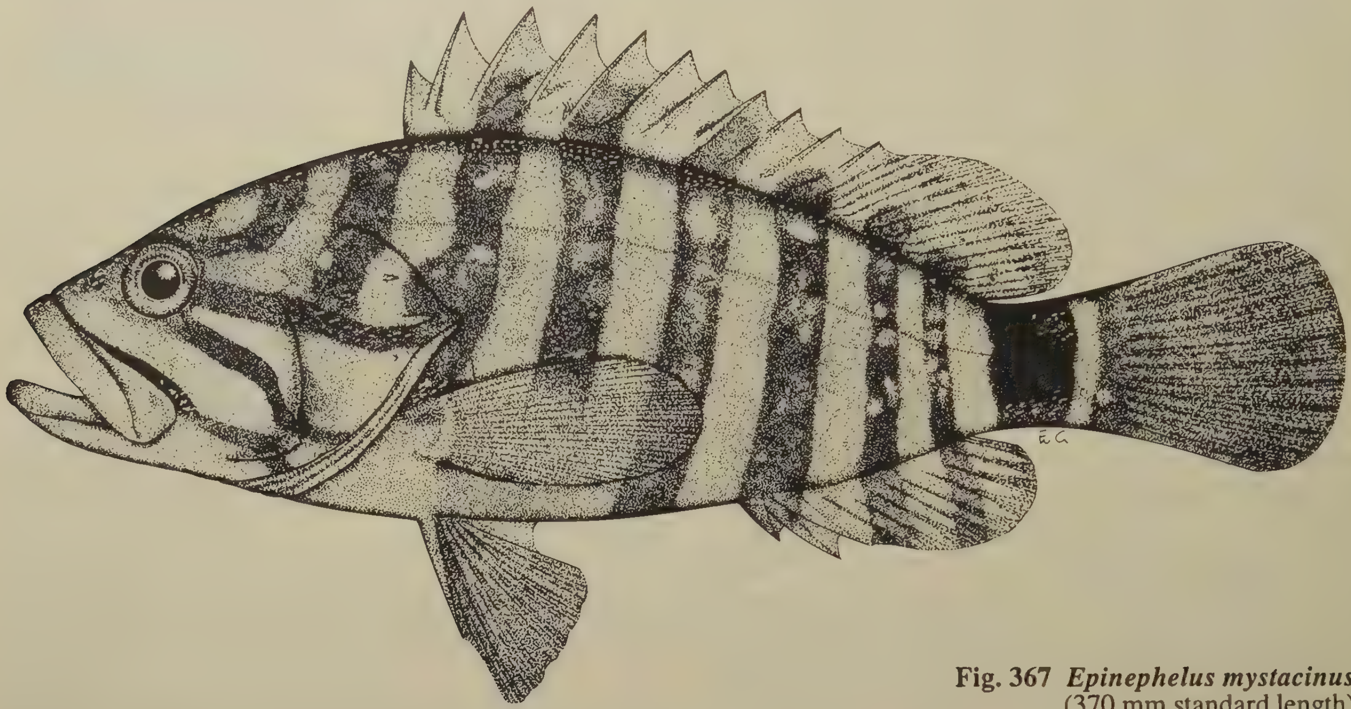


Fig. 367 ***Epinephelus mystacinus***
(370 mm standard length)

Diagnostic Features: Body depth 2.4 to 2.9 times in standard length (for fish 14 to 40 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex; eye diameter greater than interorbital width for fish less than 30 cm standard length, but less than interorbital in fish greater than 40 cm standard length; preopercle corner rounded, with enlarged serrae, the lower edge with 1 or 2 small serrae (usually hidden by skin) just in front of corner; interopercle and subopercle serrate; posterior nostrils greatly enlarged, their diameter 4 or more times that of anterior nostrils. Gill rakers 8 to 10 on upper limb and 14 to 16 on lower limb, total 22 to 26. Dorsal fin with XI spines and 14 or 15 rays, the third spine longest and the membranes distinctly incised between the spines; anal fin with III spines and 9 (rarely 8) rays; pectoral-fin rays 18 or 19; pelvic fins shorter than pectoral fins and inserted slightly in front of lower end of pectoral-fin base; pelvic fins not reaching anus (except on fish less than 16 cm standard length); caudal fin rounded. Body scales distinctly ctenoid, without auxiliary scales; lateral-line scales 58 to 69; lateral-scale series 99 to 112. Pyloric caeca very numerous. **Colour**: Head and body buff, with 8 or 9 dark, subvertical bars on body, the first on nape, the last two (which are darker than other bars) may be fused to form a wide dark band around caudal peduncle; width of dark body bars equal to or less than width of pale interspaces; dark bars faint on large adults. Pelvic fins blackish brown. Prominent blackish brown maxillary streak on cheek along upper edge of maxilla.

Geographical Distribution: Western Atlantic: Bermuda, North Carolina, Florida, Gulf of Mexico, Bahamas, Cuba, Yucatan, Jamaica, Puerto Rico, the Virgin Islands, and the Leeward Islands to Trinidad. Eastern Pacific: Galapagos (Fig. 368).

Habitat and Biology: A deep-water species reported from depths of 100 to 400 m; juveniles occasionally found in water as shallow as 30 m. Like most groupers, it is a generalized carnivore, feeding on fishes, crustaceans, and squids. Virtually nothing is known of the age, growth, or reproduction of this species; females attain at least 100 cm.

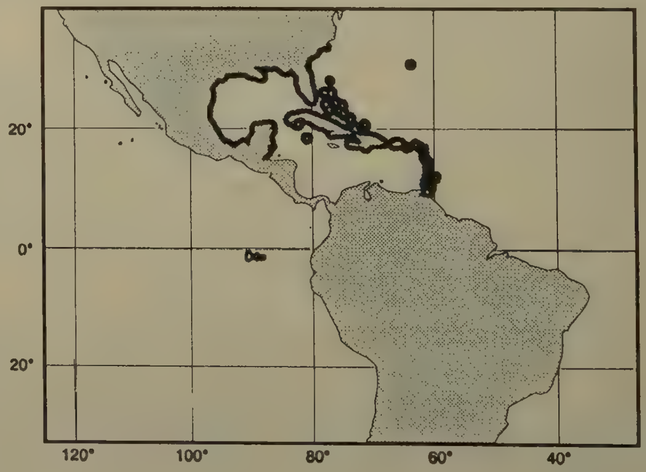


Fig. 368

Size: Attains at least 115 cm total length and over 54 kg.

Interest to Fisheries: *E. mystacinus* is the dominant grouper in the deep-water sport and commercial fisheries of the Virgin Islands. In 1958 this species was reported to be of some commercial importance in Bermuda.

Local Names: USA: Moustache grouper, Convict grouper; VENEZUELA: Cherna del alto.

Literature: Rivas (1964); Robins (1967); Smith (1971); Brownell and Rainey (1971); Acero and Garzon (1983); Thompson and Munro (1983); Johnson and Keener (1984); Bullock and Smith (1991).

Remarks: Johnson and Keener (1984) questioned the locality of Seale's (1940) record of a 40 mm *E. mystacinus* from the Galapagos, because there were no other records of the species from the Pacific. But we have examined a 108 mm juvenile (LACM 44012-2) collected in June 1984 at Isabela Island in the Galapagos by Jack Grove.

Katayama (1975, 1988) reported "*Epinephelus mystacinus*" from Japan, but this was based on misidentification of *E. octofasciatus*, which has more scales (lateral-scale series 114 to 126), the pelvic fins subequal to or longer than the pectoral fins, and the dark body bars wider than the pale interspaces.

E. septemfasciatus of Japan differs from *E. mystacinus* in having the dark body bars wider than the pale interspaces, and the broad dark bar covering the caudal peduncle extends over the last 2 or 3 dorsal-fin rays.

Epinephelus nigritus (Holbrook, 1855) Fig. 369; Pl. XIXF SERRAN Epin 20

Serranus nigritus Holbrook, 1855:17, pl. 25, fig. 2 (type locality: Charleston, S.C.).

Synonyms: *Centropristis merus* Poey, 1868:288 (type locality: Cuba).

FAO Names: **En** - Warsaw grouper; **Fr** - Mérou varsovie (formerly: Mérou polonaise); **Sp** - Mero negro.

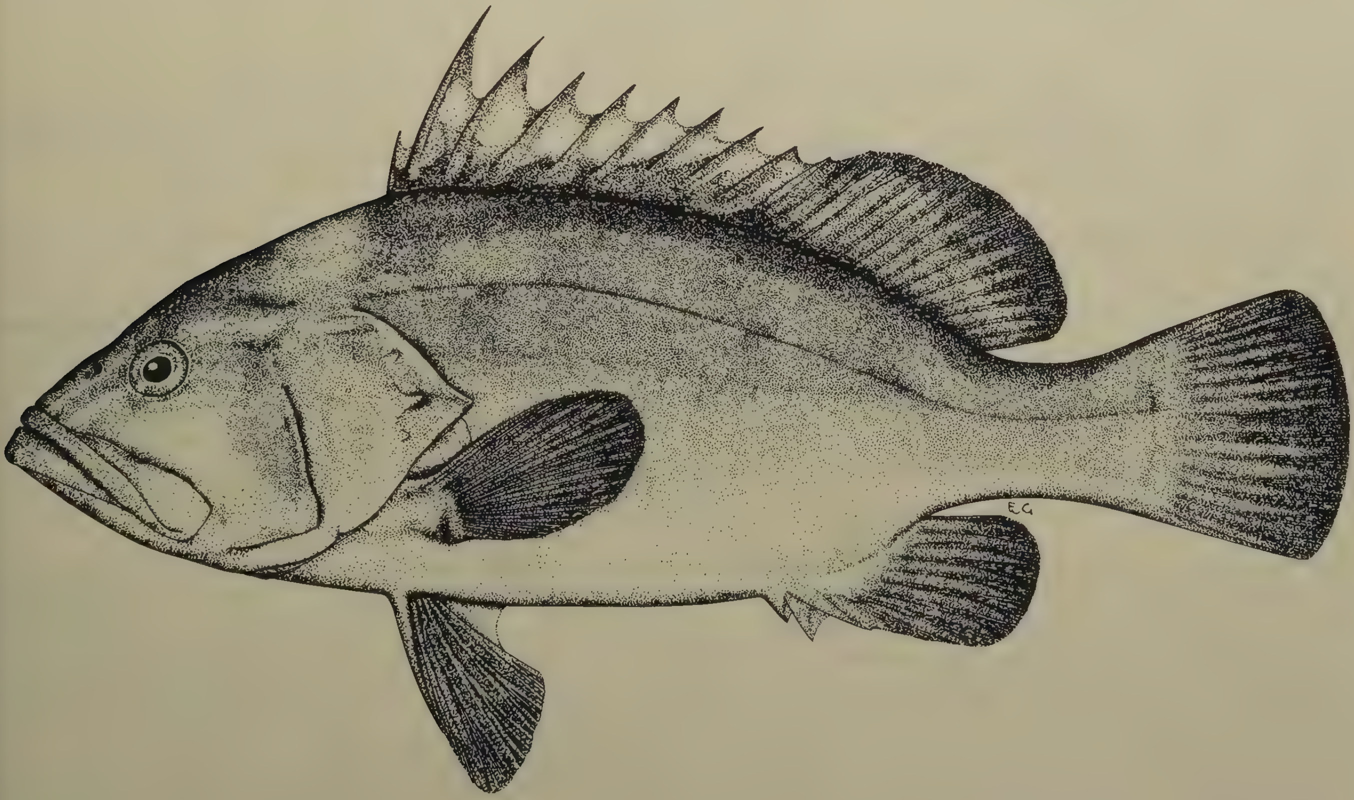


Fig. 369 *Epinephelus nigritus*
(581 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.4 to 2.6 times in standard length (for fish 11 to 58 cm standard length). Head length contained 2.1 to 2.5 times in standard length; interorbital area distinctly convex, wider than eye diameter for fish larger than 15 cm standard length; preopercle angular, but the corner rounded, with slightly enlarged serrae and 1 or 2 small spines on lower edge just in front of corner; interopercle and subopercle smooth; nostrils subequal, or rear nostril slightly larger; maxilla reaches well past eye; adults with 4 or 5 rows of teeth at midside of lower jaw, juveniles with 2 or 3 rows. Gill rakers 9 to 11 on upper limb and 14 to 16 on lower limb, total 23 to 25. Dorsal fin with X spines and 13 to 15 rays, the second spine distinctly longer than the others (in fish greater than 40 cm standard length) and the interspinous membranes deeply incised; anal fin with III spines and 9 rays; pectoral-fin rays 18 or 19; pelvic fins longer than pectoral fins in fish 7 to 58 cm standard length and inserted in front of vertical from lower end of pectoral-fin base; rear margin of caudal fin convex or truncate with rounded corners. Midlateral-body scales distinctly ctenoid, with auxiliary scales in adults; lateral-line scales 62 to 71; lateral-scale series 99 to 107. Pyloric caeca very numerous, in a large dendritic mass. **Colour**: Dark reddish brown or brownish grey to almost black dorsally, dull reddish grey below. Juveniles with yellow caudal fin and a few randomly scattered whitish spots on body; no dark saddle blotch on peduncle.

Geographical Distribution: Western Atlantic from Massachusetts to Gulf of Mexico, Cuba, Trinidad, and Rio de Janeiro (Fig. 370). Reports of ***E. nigritus*** from the eastern Pacific (C.L. Smith, 1971) are apparently based on misidentifications of ***Epinephelus exsul***. Warsaw grouper seem to be rare in the West Indies, with single records from Cuba, Haiti, and Trinidad; this rarity and their apparent absence from the western Caribbean shelf may be due to the dearth of deep-water fishing in this area.

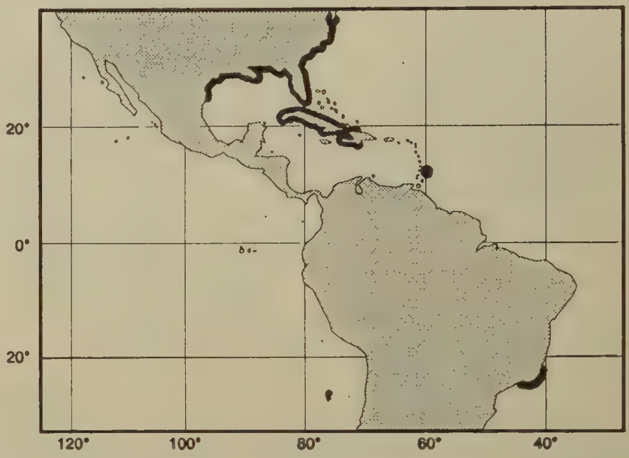


Fig. 370

Habitat and Biology: Adults are usually found on rough, rocky bottom in depths of 55 to 525 m; juveniles are occasionally seen on jetties and shallow-water reefs. Adults feed on a variety of crabs, shrimps, lobsters, and fishes.

According to Manooch and Mason (1987), ***E. nigritus*** is a long-lived, slow-growing species that may reach an age of 41 years. Average total lengths for fish aged 1, 5, 10, 25 and 41 years are 30, 92, 119, 188 and 233 cm respectively. The von Bertalanffy growth equation is:

$L_t = 2394(1\text{-}e^{-0.0544(t+3616)})$ where L_t equals total length in millimetres at age (t) in years.

Size: Maximum total length 230 cm; maximum weight 200 kg. The 1991 edition of *World Record Game Fishes* published by the International Game Fish Association lists the all-tackle record for ***E. nigritus*** as 198.10 kg for a fish caught off Destin, Florida.

Interest to Fisheries: Because of its large size, the Warsaw grouper is of considerable importance in the sport fishery for bottom fishes, but it contributes less than 1% of the commercial grouper landings on the southeast coast of the U.S. In the 1983-84 commercial fishery on the Florida West coast, Warsaw groupers accounted for about 55 metric tons. The species is also common in the western Gulf of Mexico and southern Caribbean (from Venezuela to French Guiana, but not reported from Venezuela by Cervigón, 1966). It is caught mainly with hook-and-line and bottom longlines.

Local Names: CUBA: Mero de lo alto.

Literature: Rivas (1964) Smith (1971, in part); Johnson and Keener (1984); Manooch (1984); Bullock and Smith (1991).

Remarks: ***E. nigritus*** was reported from the Eastern Pacific by C.L. Smith (1971), but the eastern Pacific specimens that he listed are a similar species, ***E. exsul***, which is known only from the Eastern Pacific. Although we have examined only 6 small juveniles (27 to 109 mm standard length) of ***E. exsul***, we believe that this species is distinct from ***E. nigritus***. It differs from ***E. nigritus*** in having 8 anal-fin rays, 87 to 92 lateral-scale series, body depth contained 2.3 times in standard length, and pelvic fins equal to or shorter than pectoral fins.

E. nigritus differs from ***E. niveatus*** in having X dorsal-fin spines (always XI spines in ***E. niveatus***) and in the colour pattern (***E. niveatus*** juveniles have the whitish spots in a regular grid-like pattern on the body and a large black saddle blotch on the caudal peduncle).

Epinephelus niphobles Gilbert and Starks, 1897

Fig. 371

SERRAN Epin 64

Epinephelus niphobles Gilbert and Starks in Gilbert, 1897:442 (type locality: Magdalena Bay, Baja California).

Synonyms: ?*Epinephelus peruanus* Chirichigno, 1963:44, fig. 37B (type locality: Puerto Pizarro, Peru).

FAO Names: **En** - Star-studded grouper; **Fr** - Mérou tacheté; **Sp** - Mero machado.

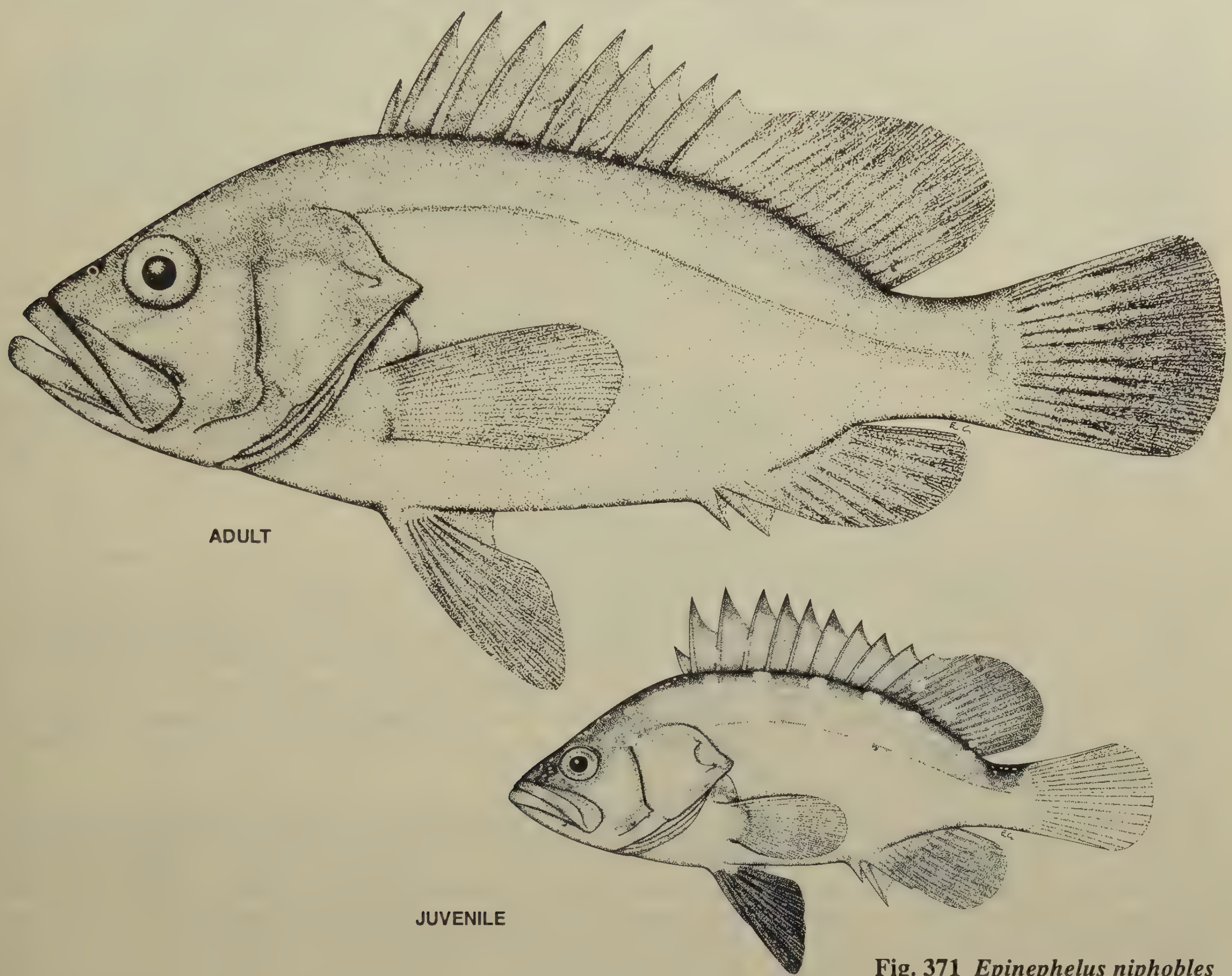


Fig. 371 ***Epinephelus niphobles***
(adult 229 mm standard length, juvenile 60 mm standard length)

Diagnostic Features: Body depth contained 2.3 to 2.7 times in standard length (for fish 14 to 47 cm standard length). Head length contained 2.2 to 2.5 times in standard length; interorbital convex, the width subequal to eye diameter for fish 5 to 22 cm standard length and greater than eye diameter for fish larger than 30 cm standard length; corner of preopercle slightly produced, with enlarged serrae; some specimens with a tiny spine (hidden by skin) on ventral edge of preopercle; upper edge of operculum distinctly convex; posterior nostrils vertically elongate, 2 to 5 times larger than anterior ones; maxilla reaches to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 9 on upper limb, 15 to 17 on lower limb, total 23 to 26. Dorsal fin with XI spines, and 13 to 15 rays, the second spine longest in adults, and the membranes deeply incised between the spines; anal fin with III spines and 9 rays; pectoral-fin rays 17 to 21 (mean = 19.1); pelvic-fin origin below or anterior to pectoral-fin base; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.6 to 2.1 times in head length; caudal fin convex in juveniles, truncate in adults. Midlateral-body scales rough, no auxiliary scales; lateral-line scales 63 to 71; lateral-scale series, 100 to 106. **Colour**: Juveniles (5 to 15 cm) dark reddish brown with white spots in a grid-like pattern of vertical series and horizontal rows on body and dorsal fin; dark saddle blotch usually visible on caudal peduncle; caudal and pectoral fins pale (yellow in life?); anal and pelvic fins dark brown; maxillary groove black. Adults dark brown, without white spots.

Geographical Distribution: *E. niphobles* is an eastern Pacific species known from southern California to Peru (Fig. 372).

Habitat and Biology: According to Thomson et al. (1979: fig. 44, a juvenile identified as "*Epinephelus niveatus*"), "This deep-water grouper is often caught in shrimp trawls in the central Gulf."

Size: Attains at least 48 cm standard length, probably much larger.

Interest to Fisheries: Apparently too rare to be of commercial interest.

Local Names: USA: Snowy grouper.

Literature: Smith (1971, in part); Chirichigno (1978, misidentified as *E. niveatus*).

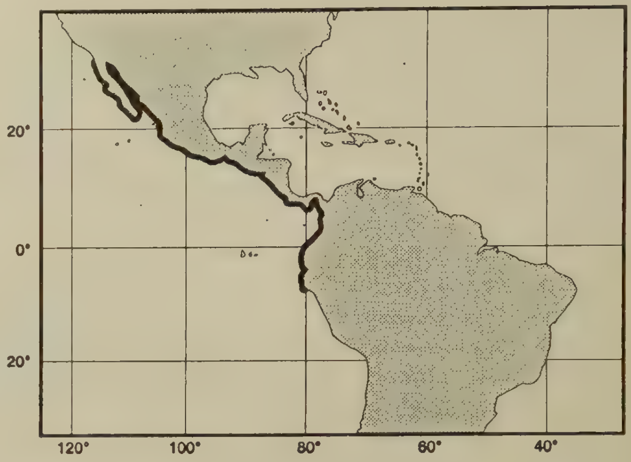


Fig. 372

Remarks: *E. niphobles* is most similar to *E. niveatus* of the western Atlantic and Caribbean. The colour pattern of the juveniles is virtually identical; and the meristic data are the same, except for the pectoral-fin rays (*E. niphobles* with a mode of 19 rays and *E. niveatus* with 18). But direct comparison of like-sized small juveniles (5 to 10 cm standard length) shows noticeable differences in certain morphological characters: *E. niveatus* has a larger eye (eye diameter subequal to snout length and at least 1 mm greater than interorbital width; *E. niphobles* with eye diameter distinctly less than snout length and less than or subequal to interorbital width), pelvic fins distinctly longer than pectoral fins (*E. niphobles* with pelvic fins less than or subequal to pectoral fins), and there is no serrate lobe at the preopercle angle (*E. niphobles* with a small serrate lobe at corner of preopercle).

C.L. Smith (1971) regarded *E. niphobles* as a synonym of *E. niveatus*. Although the morphological differences between *E. niveatus* and *E. niphobles* are slight, we regard these two taxa as distinct species.

We have not examined the types of *E. peruanus* Chirichigno, 1963, but judging from the original description, it appears that her species is a synonym of *E. niphobles*. In the original description of *E. peruanus* the dorsal-fin formula is given 4 times as "XI,14," and the figure also shows XI dorsal-fin spines; but in her 1978 paper on new additions to the ichthyofauna of Peru, Chirichigno (1978:84) stated that *E. peruanus* differed from *E. niveatus* in having only X dorsal-fin spines! This is presumably a lapse arising from confusion of *E. peruanus* with *E. exsul*.

E. niphobles differs from *E. cifuentesi* in the colour pattern of the juveniles, in having fewer lateral-scale series (100 to 106 versus 131 to 144 in *E. cifuentesi*), and fewer gill rakers (23 to 26 versus 27 to 31 in *E. cifuentesi*).

E. exsul differs in having only X dorsal-fin spines, 8 anal-fin rays, and a different colour pattern (with pale spots faint and scattered randomly over the body).

Epinephelus niveatus (Valenciennes, 1828)

Fig. 373; Pl. XXA

SERRAN Epin 21

Serranus niveatus Valenciennes in Cuv. and Val., 1828:380 (type locality: Brazil).

Synonyms: *Serranus margaritifer* Günther, 1859:131 (type locality: South America [probably Guyana]). *Serranus conspersus* Poey, 1860:139 (type locality: Cuba). *Hyporthodus flavicauda* Gill, 1862b:98 (type locality: Newport, Rhode Island, USA). *Alphestes scholanderi* Walters, 1957:383, fig. 1 (type locality: Bimini, Bahamas).

FAO Names: En - Snowy grouper; **Fr** - Mérou neige; **Sp** - Cherna pintada.

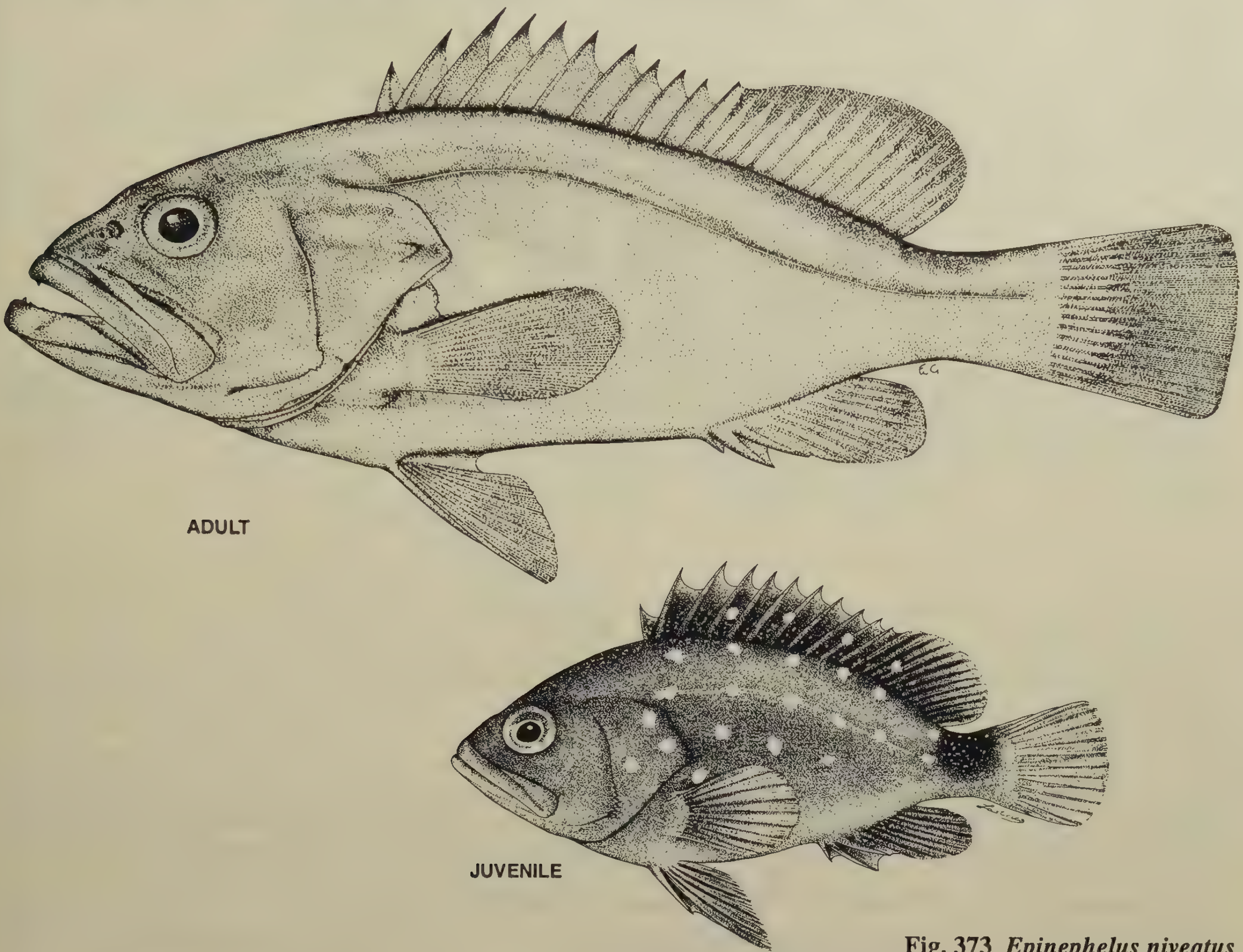


Fig. 373 ***Epinephelus niveatus***
(adult 383 mm standard length, juvenile 88 mm standard length)

Diagnostic Features: Body depth contained 2.4 to 2.8 times in standard length (for fish 10 to 38 cm standard length), 2.8 to 3.1 times for fish 75 to 93 cm standard length. Head length contained 2.2 to 2.4 times in standard length (for fish 10 to 38 cm standard length), 2.4 to 2.6 times for fish 75 to 93 cm standard length; interorbital convex, the width less than or subequal to eye diameter in fish 10 to 20 cm standard length; in fish 30 to 93 cm standard length, the interorbital width is 1.1 to 1.9 times eye diameter; preopercle with enlarged serrae at the angle; often a tiny antrorse spine, covered with skin, on lower edge just in front of the angle; upper edge of operculum distinctly convex; rear nostrils 2 to 5 times larger than front ones. Gill rakers 7 to 10 on upper limb, 15 to 17 on lower limb, total 22 to 26. Dorsal fin with XI spines and 13 to 15 rays, the second or third spine longest, the membranes deeply incised between the spines; anal fin with III spines and 9 rays; juveniles with pelvic fins longer than pectoral fins; in fish 40 to 60 cm standard length, the pectoral and pelvic fins are about equal, and in large adults (over 60 cm standard length), the pectoral fins are slightly longer than the pelvic fins; pelvic-fin origin anterior to pectoral-fin base; pectoral-fin rays 17 to 19 (3:17, 63:18, 1:19); rear margin of caudal fin convex in juveniles (less than 30 cm standard length), straight or concave in adults. Midlateral-body scales rough; lateral-line scales 64 to 73; lateral-scale series 102 to 128. Pyloric caeca numerous. **Colour:** Adults dark brown, the spinous dorsal-fin margin black (except in large adults). The live colour of the holotype of ***Alphestes scholanderi***, 76 cm standard length, was described as "... coppery gold with about 18 narrow, wavy, vertical, dark bands on the sides, a broad dark band across the lower part of the opercle and another across the preopercle." (Walters, 1957). Juveniles dark brown with conspicuous white spots in about 11 vertical series and 5 or 6 longitudinal rows, usually extending onto head and dorsal fin (white spots visible on fish 6 to 40 cm standard length); caudal and pectoral fins pale yellow; a black saddle blotch on caudal peduncle reaching below lateral line.

Geographical Distribution: Western Atlantic from Massachusetts to the Gulf of Mexico, Bermuda, the Caribbean, and southern Brazil (Fig. 374).

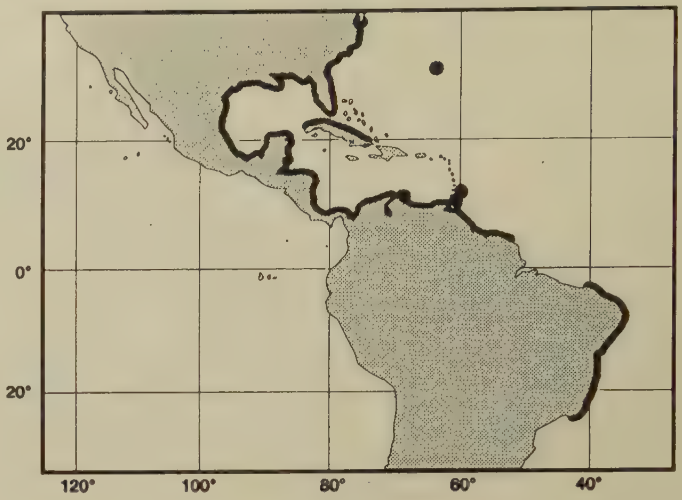


Fig. 374

Habitat and Biology: Adults occur well offshore on rocky bottoms at depths of 30 to 525 m but are most common between 100 and 200 m. Juveniles may be found inshore and are often reported from the northeastern coast of the U.S. Most females are mature by age 4 or 5 (40 to 50 cm total length); as expected for a protogynous species, males less than 6 years old (55 to 60 cm) were not found, and 40% of all fish 8 years or older (70 cm) were males; spawning occurs off the Florida Keys from April to July (Moore and Labisky, 1984). The maximum age attained is at least 27 years. Age and growth parameters of this relatively unexploited population in the lower Florida Keys were reported by Moore and Labisky (1984):

$W = 2.45 \times 10^{-8} L^{2.93}$ with weight (W) in kg and total length (L) in millimetres.

$L_t = 1320(1 - e^{-0.087(t-1.013)})$, where total length ($L_t$) is in millimetres and age (t) is in years.

Adults feed mainly on fishes, gastropods, cephalopods, and brachyuran crustaceans.

Larvae of 5.5 to 10.3 mm standard length were described and illustrated by Presley (1970). Johnson and Keener (1984) illustrated the second dorsal- and pelvic-fin spines of 8.7 and 13.1 mm larvae identified as "*Epinephelus niveatus/flavolimbatus*."

Size: Maximum total length about 120 cm; maximum weight 30 kg.

Interest to Fisheries: Commercially important stocks occur off the southeast coast of the U.S. (North Carolina to Georgia), Florida west coast, lower Florida Keys, Honduras/Nicaraguan shelf, and off Panama, Colombia, and Venezuela. Caught with hook-and-line, bottom longlines, and with traps.

Local Names: BRAZIL: Cherne; CUBA: Cherna manchada; VENEZUELA: Cherna pintada.

Literature: Smith (1971); Matheson and Huntsman (1984); Moore and Labisky (1984); Bullock and Smith (1991).

Remarks: C.L. Smith (1971) synonymized the eastern Pacific species ***E. niphobles*** with ***E. niveatus***. See Remarks section of ***E. niphobles*** for a discussion of our reasons for recognizing these taxa as separate species. ***E. niveatus*** was compared with ***E. flavolimbatus*** in the account of the latter species.

The type locality of ***Serranus margaritifer*** Günther is probably Guyana, as the type was presented to the British Museum by Sir R. Schomburgk, who collected fishes in the Orinoco River and along the coast of Guyana (Schomburgk, 1841). The original illustration of ***S. margaritifer***, which was cited in the text of Günther's (1859) *Catalogue* as "Plate 9, fig. b," was actually published 36 years later by Boulenger (1895:pl. 3, fig. B).

Epinephelus octofasciatus Griffin, 1926

Fig. 375; Pl. XXB

SERRAN Epin 53

Epinephelus octofasciatus Griffin, 1926:540, pl. 95 (type locality: Arid Island, Great Barrier Island, New Zealand).

Synonyms: ***Epinephelus compressus*** Postel, Fourmanoir and Guézé, 1963:364, fig. 8 (type locality: Réunion). ***Epinephelus mystacinus*** (non Poey): Katayama, 1975, 1988. Often misidentified as ***E. septemfasciatus***.

FAO Names: **En** - Eightbar grouper; **Fr** - Mérou huit raies; **Sp** - Mero de ocho bandas.

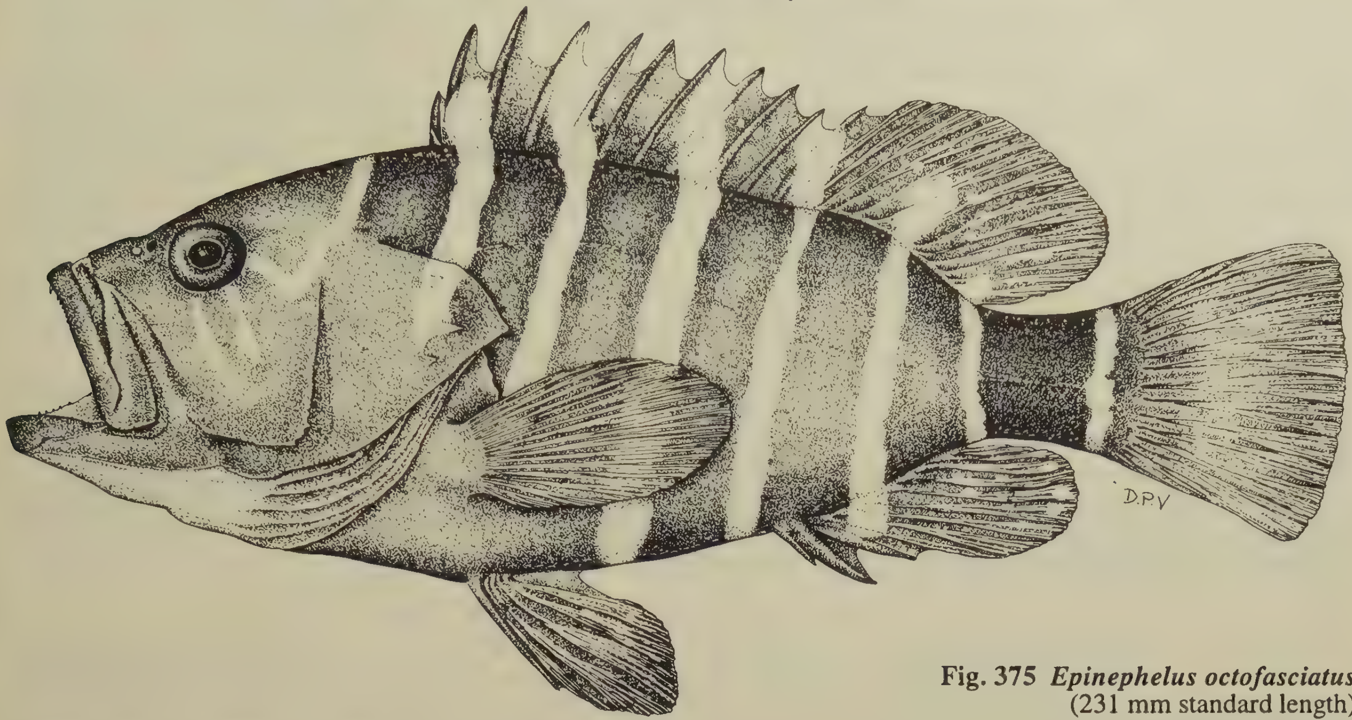


Fig. 375 *Epinephelus octofasciatus* (231 mm standard length)

Diagnostic Features: Body depth contained 2.2 to 2.7 times in standard length (for fish 10 to 47 cm standard length). Head length contained 2.4 to 2.5 times in standard length; interorbital distinctly convex, the dorsal head profile also convex; preopercle angular, the serrae at angle enlarged; lower edge of preopercle with 0 to 3 small spines anterior to angle; lower edge of subopercle and rear edge of interopercle distinctly serrate; upper edge of operculum convex; diameter of posterior nostrils 2 or 3 times that of anterior nostrils but not more than distance from rear nostril to edge of orbit; maxilla reaches to below rear half of eye; no distinct step on lower edge of maxilla; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 14 or 15 rays, the interspinous membranes deeply incised, the third or fourth spine longest, its length contained 2.5 to 2.9 times in head length and subequal to longest dorsal-fin rays; anal fin with III spines and 9 rays; pectoral-fin rays 18 or 19; pelvic fins subequal to or larger than pectoral fins, pectoral-fin length contained 1.8 to 2.0 times in head length; caudal-peduncle depth contained 0.9 to 1.3 times in its length; caudal fin rounded. Lateral-body scales ctenoid, with a few auxiliaries; lateral-line scales 65 to 71; lateral-scale series 114 to 126. Pyloric caeca very numerous, in 3 or 4 dendritic bundles with more than 80 terminal branches. **Colour**: Body buff with 8 broad dark brown bars, first on nape, second at dorsal-fin origin and covering first 2 dorsal spines, seventh bar broader than sixth and extending from base of middle 5 to 7 dorsal-fin rays to rear half of anal-fin base, 2 pale interspaces below soft dorsal fin, last bar covering most of caudal peduncle and base of last 2 or 3 dorsal-fin rays; pelvic fins and distal half of soft dorsal and anal fins blackish brown; faint dark brown band from eye to middle opercle spine; blackish maxillary streak present; some specimens with narrow white margin at corners of caudal fin, lower edge of anal fin and anterior two-thirds of edge of soft dorsal fin. Gill rakers and gill arches covered with minute melanophores.

Geographical Distribution: Indo-West Pacific from South Africa to Japan, Australia and New Zealand; except for Japan, China and Korea (Fig. 376), most distribution records for "*E. septemfasciatus*" are probably based on *E. octofasciatus*.

Habitat and Biology: Probably rocky reefs. Postel et al., (1963) reported *E. octofasciatus* (as "*E. compressus*") from depths of 150 to 300 m in the Mascarene Islands.

Size: Attains at least 80 cm total length (12 kg).

Interest to Fisheries: The apparent rarity of *E. octofasciatus* may be due to its preference for relatively deep water. Caught with hook-and-line and on vertical longlines.

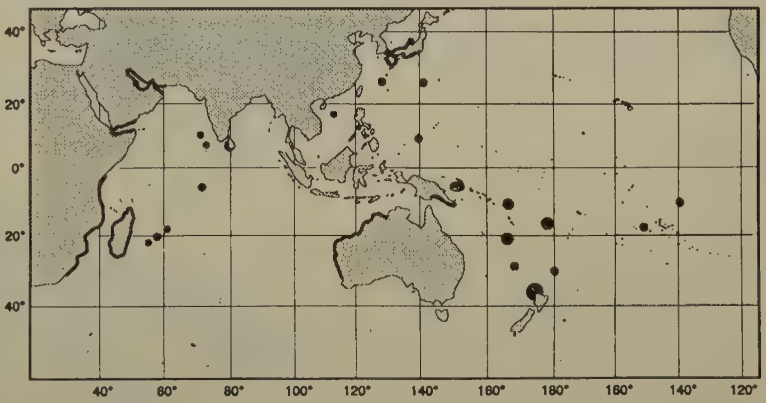


Fig. 376

Local Names: JAPAN: Mahata-modoki; MAURITIUS: Vieille plate grise; NEW CALEDONIA: Loche plate grise; REUNION: Plat.

Literature: Randall and Heemstra (1991).

Remarks: ***E. octofasciatus*** is closely related to ***E. septemfasciatus***, which differs in having the body depth usually less (depth contained 2.5 to 3.1 times in standard length), caudal peduncle usually more slender (peduncle depth contained 1.2 to 1.5 times in its length), diameter of rear nostrils greater than distance from nostril to orbit, and in the configuration of the dark body bars (6 dark bars wholly below dorsal fin and 2 narrow dark bars below middle rays of soft dorsal fin; 3 pale interspaces below soft dorsal fin). Katayama (1975, 1988) identified the ***E. octofasciatus*** in Japan as "***Epinephelus mystacinus*** Poey," which also has 8 dark bars on the body; but ***E. mystacinus*** has fewer lateral-scale series (99 to 112), the pelvic fins are shorter than the pectoral fins, and the dark bars on the body are narrower (their width equal to or less than the pale interspaces). ***E. mystacinus*** is known from the western Atlantic and the Galapagos Islands.

E. ergastularius, which is known only from the east coast of Australia, is another similar species. Adults have a truncate or emarginate caudal fin and fine dermal ridges on the body at the base of the dorsal fin; also, the fins have white margins. Juveniles can be distinguished by the spacing of the dark brown bars on the body: on ***E. ergastularius*** the pale space separating the second and third dark bars and that between the fourth and fifth bars is distinctly narrower than the interspaces between the third and fourth or fifth and sixth bars; on ***E. octofasciatus*** all the pale interspaces are about the same width.

Epinephelus ongus (Bloch, 1790)

Fig. 377; Pl. XXC

SERRAN Epin 46

Holocentrus Ongus Bloch, 1790:69, pl. 234 (type locality: "Japan").

Synonyms: ***Serranus dichropterus*** Valenciennes in Cuv. and Val., 1828:293 (unnecessary replacement name for ***Holocentrus ongus*** Bloch). ***Serranus reticulatus*** Valenciennes in Cuv. and Val., 1828:323 (type locality: Java). ***Serranus tumilabrus*** Valenciennes in Cuv. and Val., 1828:346 (type locality: Seychelles). ***Serranus bataviensis*** Bleeker, 1849:38 (type locality: Jakarta, Java). ***Epinephelus summana hostiaretis*** Whitley, 1954:25 (type locality: Queensland, Australia). ***Epinephelus slacksmithi*** Whitley, 1959:312 (type locality: Heron Island, Queensland, Australia).

FAO Names: **En** - White-streaked grouper; **Fr** - Mérou à flocons; **Sp** - Mero nubifero.

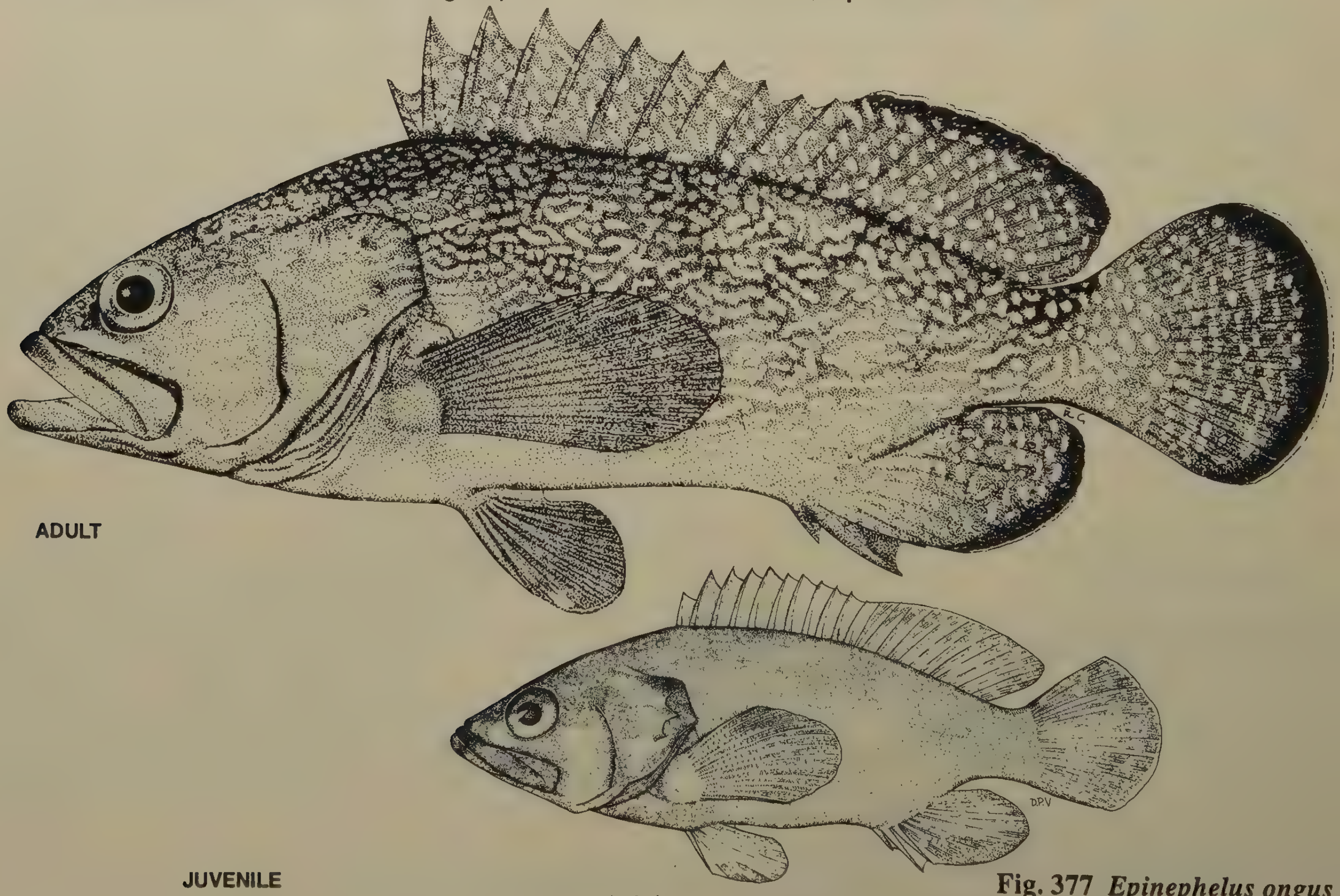


Fig. 377 ***Epinephelus ongus***
(adult 222 mm standard length, juvenile 112 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.2 times in standard length (for fish 11 to 25 cm standard length); body width contained 1.7 to 2.2 times in the depth. Head length contained 2.3 to 2.5 times in standard length; head pointed, the interorbital area flat, the dorsal head profile slightly convex; preopercle rounded, the serrae small and mostly covered by skin; upper edge of operculum strongly convex, the rear edge almost vertical, the upper spine extending posterior to lower spine; posterior nostril diameter about twice that of anterior nostril; maxilla reaches to or slightly past vertical at rear edge of eye; small, embedded scales on maxilla; teeth small, 2 to 4 rows at midlateral part of lower jaw; canines at front of jaws small or absent. Gill rakers 8 to 10 on upper limb, 15 to 18 on lower limb (including 6 to 8 rudiments on each limb). Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, its length contained 2.6 to 3.4 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral fins large and fleshy, with 15 to 17 rays; pectoral-fin length contained 1.4 to 1.7 in head length; pelvic fins end well short of anus, their length contained 2.0 to 2.3 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 53; lateral-scale series 95 to 109. **Colour**: Body brown, with numerous small white spots which, in fish larger than 10 cm standard length are horizontally elongate and, in adults, tend to form wavy white lines; several round or irregular pale blotches (eye-sized or larger) usually superimposed over small white spots; head brown, with numerous small white spots dorsally behind eyes; black maxillary streak usually hidden by maxilla; median fins with small white spots and streaks, the posterior margin blackish with a white edge; paired fins greyish brown. Juveniles of about 6 cm standard length are brown, covered with small, dark-edged white spots which are round, except on front part of dorsal fin where they are elongated; the white spots on the paired fins become fewer and fainter with growth, and are absent in adults.

Geographical Distribution: *E. ongus* is widely distributed in the Indo-Pacific region, from the east coast of Africa (northern Mozambique to Kenya) to the Ryukyu and Marshall Islands and south to Fiji, New Caledonia and northern Australia (Fig. 378). It is replaced in the Red Sea by the closely-related endemic *E. summana*. Most of the verifiable records for *E. ongus* are from islands, and as far as we know, it does not occur in the Persian Gulf or on the coasts of Arabia, India, Sri Lanka, or Asia. We have examined specimens from Mozambique, Zanzibar, Kenya, Madagascar, Seychelles, Indonesia, Philippines, Ryukyus, New Guinea, Solomon Islands, Australia (northwestern Australia to southern Queensland), Palau Islands, Caroline Islands, Marshall Islands, Santa Cruz Islands, New Hebrides, New Calendonia, and Fiji.

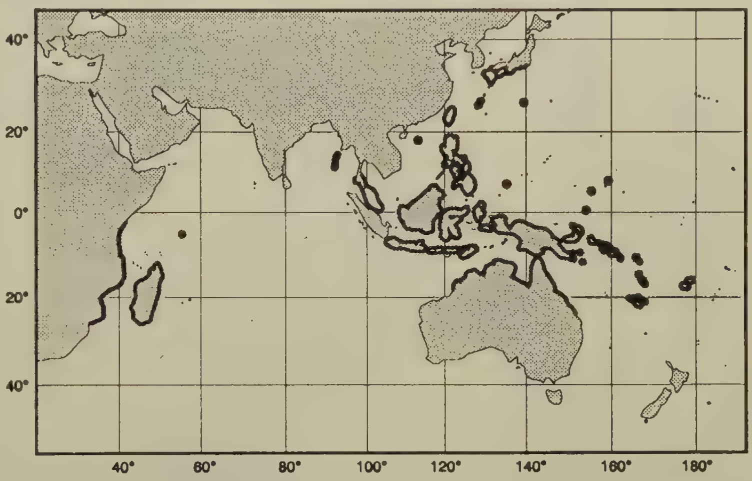


Fig. 378

Habitat and Biology: *E. ongus* occurs in shallow water on coral reefs and rocky substrata. According to Myers (1989) "*E. ongus* occurs primarily on inner coastal and lagoon reefs, even in brackish water, where it frequents ledges and caves at depths of 5 to 25 m."

Size: Myers (1989) and Katayama (1988) give a maximum size of 40 cm standard length, but the largest specimen that we have seen was 25 cm standard length (31 cm total length). Sizes over 40 cm that have been attributed to *E. ongus* probably refer to *E. caeruleopunctatus*, with which it is often confused.

Interest to Fisheries: Although this cryptic species is not very common, it is of some interest to fisheries in Japan (and probably elsewhere). It is caught with hook-and-line, spear, and traps.

Local Names: AUSTRALIA: Specklefin rockcod; JAPAN: Namihata; NEW CALEDONIA: Loche à taches claires.

Literature: Randall and Heemstra (1991).

Remarks: *E. ongus* is closely related to *E. summana*, which is endemic to the Red Sea. It differs from *E. ongus* in having shorter pectoral fins (length contained 1.65 to 2.1 times in head length), shorter pelvic fins (length contained 2.2 to 2.7 times in head length), and the posterior nostrils of adults are vertically elongated (their length contained 2 to 4 times diameter of anterior nostrils). The white-edged black margin on the median fins of *E. ongus* is poorly developed or absent in *E. summana*.

The sympatric *E. caeruleopunctatus* has a similar colour pattern, but the caudal and anal fins have only a few white spots (confined mainly to proximal part of these fins), and the paired fins of juveniles are mostly unspotted. It also has 17 to 19 pectoral-fin rays, 51 to 61 lateral-line scales, upper edge of operculum sinuous or slightly convex, and the rear nostrils of adults are vertically elongated, their length 5 or 6 times diameter of front nostrils. This species also attains a larger size than *E. ongus* (at least 60 cm total length).

Epinephelus perplexus Randall, Hoese and Last, 1991

Fig. 379

SERRAN Epin 87

Epinephelus perplexus Randall, Hoese and Last in Randall and Heemstra, 1991:222, fig. 116 (new name for *Epinephelus thompsoni* Whitley, 1948:89 [a junior secondary homonym of *Stereolepoides thompsoni* Fowler, 1923 which is a junior synonym of *E. lanceolatus* (Bloch)]; type locality: 58 km northeast of Cape Moreton, Queensland).

Synonyms: None.

FAO Names: **En** - Puzzling grouper; **Fr** - Mérou curieux; **Sp** - Mero acertijo.

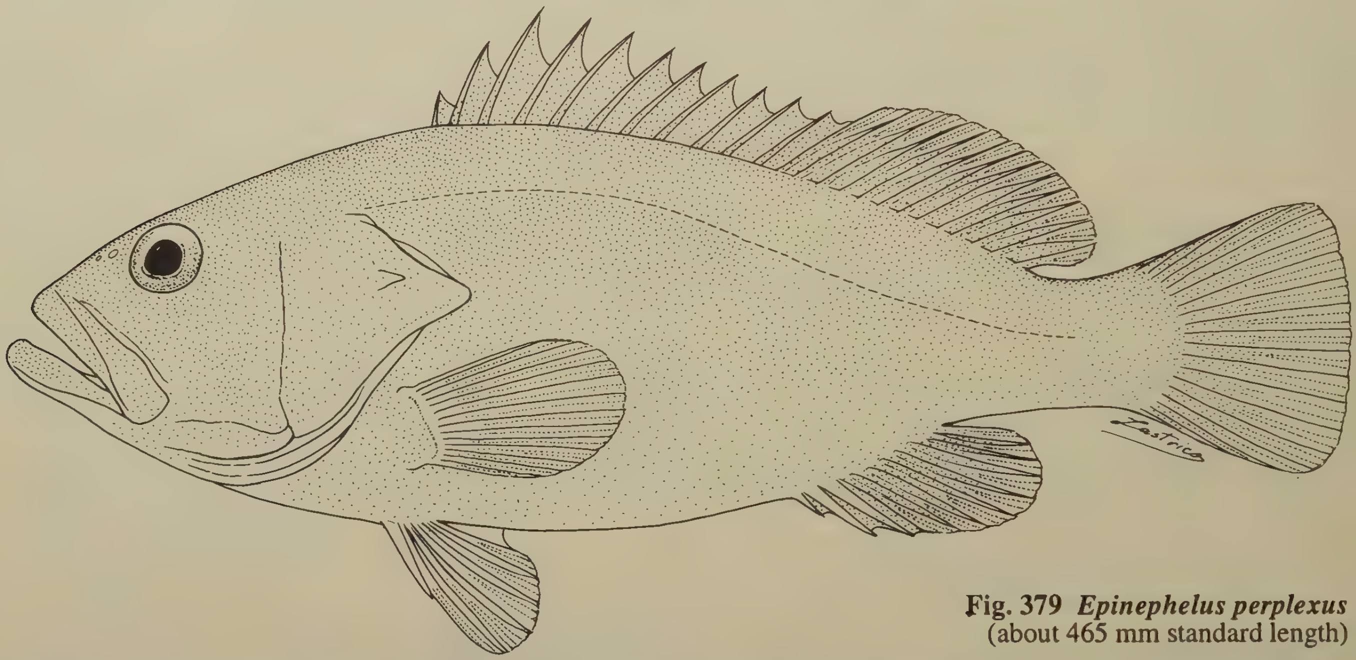


Fig. 379 ***Epinephelus perplexus***
(about 465 mm standard length)

Diagnostic Features: (Data from a 465 mm standard length fish that was fixed with its mouth wide open; hence ratios of standard length and head length are only approximate.) Body depth contained 2.9 times in standard length. Head length contained 2.3 to 2.4 times in standard length; snout length contained about 3.8 times, eye diameter contained 6.0 times, interorbital width contained 6.8 times and suborbital depth contained 9.5 times in head length; interorbital area slightly convex; preopercle finely serrate, the corner produced into a bulge bearing 7 moderately enlarged serrae; upper edge of operculum straight or nearly straight; rear nostrils ovate, about twice size of front nostrils; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 10 on upper limb, 17 on lower limb. Dorsal fin with XI spines and 13 rays, the third spine longest, its length contained 3.3 to 3.4 times in head length and slightly longer than longest dorsal-fin ray; interspinous dorsal-fin membranes deeply incised; anal fin with III spines and 8 rays; pectoral fins not fleshy, with 18 rays; pectoral-fin length contained 2.0 to 2.1 times and pelvic-fin length contained 2.5 times in head length; caudal fin slightly rounded, longest caudal-fin ray contained 2.2 times in head length. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 52; lateral-scale series 104.

Colour: "... after long preservation in formalin, light brown. Margins of unpaired fins dark brown. A dark spot on each body-scale. No dark moustache or other conspicuous markings." (Whitley, 1948).

Geographical Distribution: Known from a single specimen caught off southern Queensland, Australia (Fig. 380).

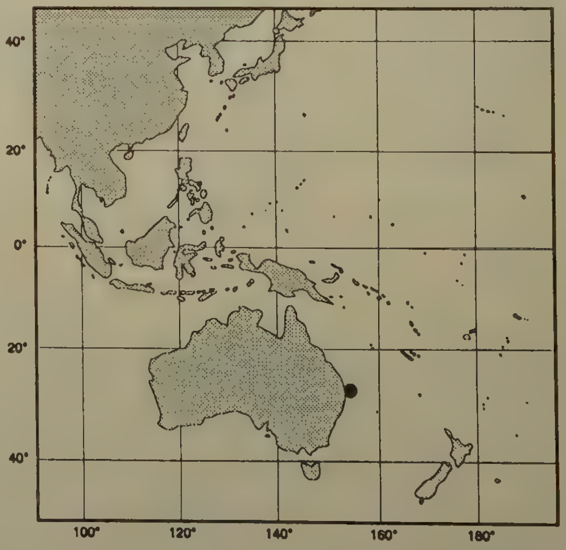


Fig. 380

Habitat and Biology: The holotype was collected at a depth of 129 to 137 m.

Size: Attains at least 46 cm standard length.

Interest to Fisheries: None.

Local Names:

Literature: Randall and Heemstra (1991); Randall et al. (1993).

Remarks: Randall et al. (1991) noted that the combination of meristic and morphological features of *E. perplexus* is unique, and differentiates this species from all other groupers. The absence of additional specimens may indicate an unusually deep habitat for this species.

Epinephelus poecilonotus (Temminck and Schlegel, 1842)

Fig. 381; Pl. XXD SERRAN Epin 47

Serranus poëcilonotus Temminck and Schlegel, 1842:6, pl.4, fig. 2 (type locality: Japan).

Synonyms: Often misidentified as "*Epinephelus morrhua.*"

FAO Names: **En** - Dot-dash grouper; **Fr** - Mérou morse; **Sp** - Mero punto y linea.

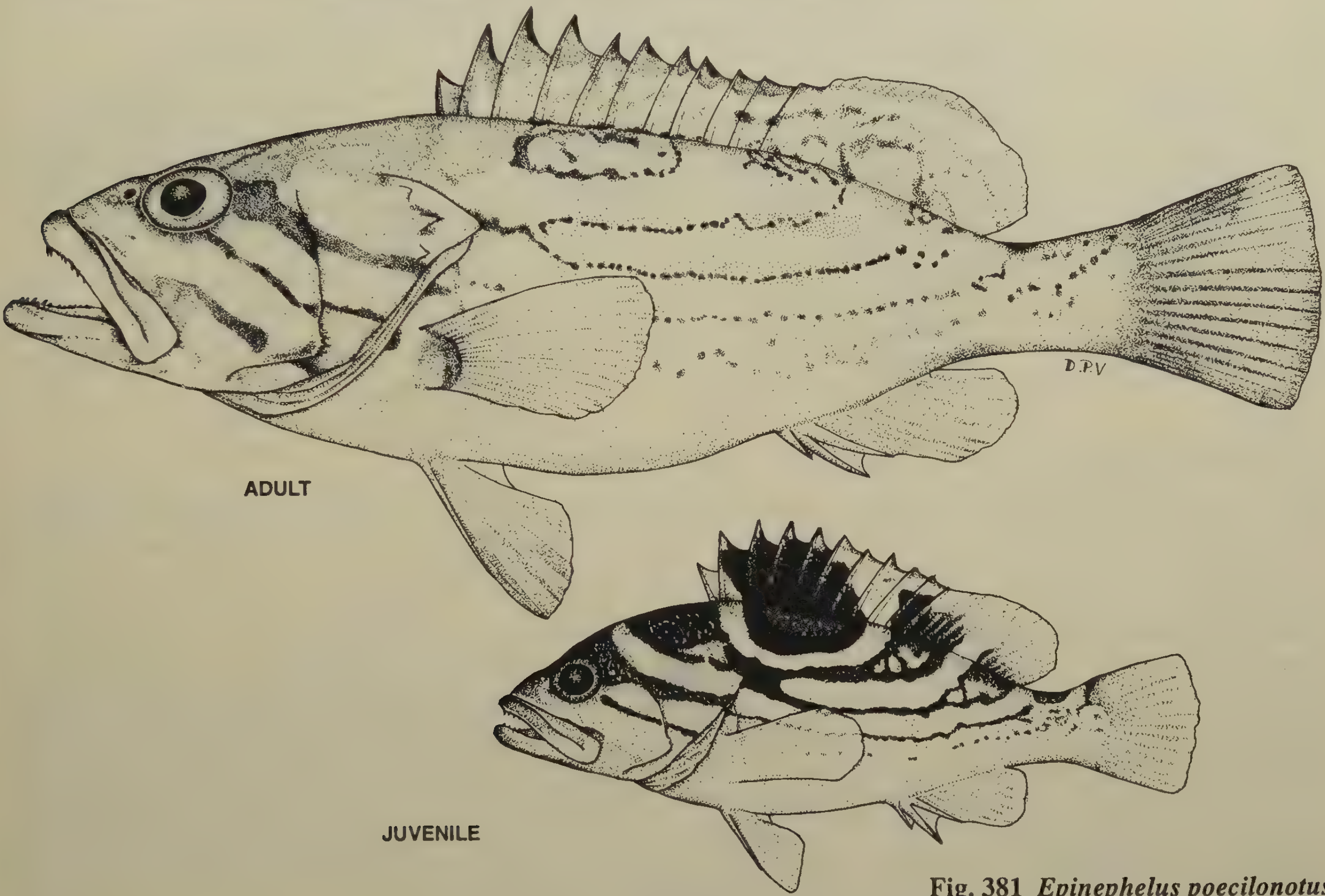


Fig. 381 ***Epinephelus poecilonotus***
(adult 286 mm standard length, juvenile 112 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 3.1 times in standard length (for fish 11 to 52 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area slightly convex; preopercle angle with 2 to 5 enlarged serrae; upper edge of operculum slightly convex; maxilla reaches about to vertical at rear edge of eye; adults with a step on ventral edge of maxilla; rear nostrils of adults larger than front ones; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 18 on lower limb; longest gill raker subequal to longest gill filaments. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.6 to 3.1 times in head length and subequal to longest dorsal-fin ray, the interspinous membranes deeply incised (adults with membrane free length at front of third and fourth spines half or more of spine length); anal fin with III spines and 8 rays; pectoral fins not fleshy, with 17 to 19 rays; pectoral-fin length contained 1.7 to 2.1 and pelvic-fin length contained 2.0 to 2.6 times in head length; caudal fin convex. Lateral-body scales ctenoid (with auxiliary scales on adults); lateral-line scales 54 to 63; lateral-scale series 110 to 121 (1 specimen from Sri Lanka with 104 and 1 from Kenya with 136). Pyloric caeca 8 or 9. **Colour:** Small juveniles (5 to 12 cm standard length) pale yellowish grey, with oval black blotch on body between bases of third to ninth dorsal-fin spines and extending to edge of fin between first and seventh spines; a semicircular pale band passes ventrally around the oval black blotch and isolates it from a dark brown band that begins broadly on nape and bifurcates just behind operculum, the upper branch curving dorsally and expanding broadly over basal half of dorsal fin between the ninth spine and fourth soft ray, the lower branch also curving dorsally and expanding at base of the last 4 dorsal-fin rays. A second curved brown band, parallel to the one above, runs from interorbital area and rear edge of eye to a black saddle spot on caudal peduncle; a third (and narrowest) dark brown band runs from lower edge of eye to subopercle and continues as a series of dark dots along ventral part of body to base of caudal fin. Fins pale yellow, except where dark markings occur on dorsal fin. On larger juveniles (15 to 25 cm standard length) the oval black blotch at base of dorsal-fin spines and the dark brown bands on body break into series of black spots, a faint dark band runs from the dark maxillary streak to corner of preopercle. On small adults (40 to 50 cm standard length) most of the dark spots on body are faint or have disappeared completely and the dark bands on head are fading too; at this stage the fins are yellowish brown, the triangular interspinous dorsal-fin margins abruptly orange-yellow or brownish yellow; soft dorsal, anal, and caudal fins shading to blackish distally with a bluish white edge.

Geographical Distribution: *E. poecilonotus* is an Indo-West Pacific species ranging from the east coast of Africa to Japan, Korea, South China Sea, Viet Nam and Fiji (Fig. 382); it is not known from the Red Sea or the Persian Gulf. We examined specimens from South Africa (Natal to Port Alfred), Mozambique, Kenya, Somalia, Comoros, Mauritius, Maldives, Sri Lanka, India, and Japan.

Habitat and Biology: This deep-water species has been taken in depths of 45 to 375 m. Morgans (1982) reported 19 specimens, (as "*Epinephelus praeopercularis*") taken by hook-and-line at the bottom in 95 to 130 m on the North Kenya Banks; these specimens were 35 to 51 cm standard length, and Morgans estimated that maturity occurs at 415 mm total length (35 cm standard length).

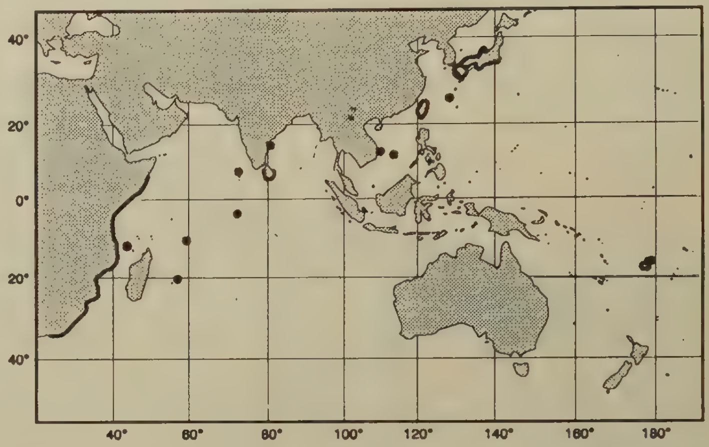


Fig. 382

Size: Attains at least 63 cm total length and a weight of 4 kg.

Interest to Fisheries: Except for Morgans' (1982) report (see above), *E. poecilonotus* seems to be rare. It is caught with hook-and-line, vertical longline, and occasionally in trawls.

Local Names: JAPAN: Iyagohata.

Literature: Katayama (1988); Randall and Heemstra (1991).

Remarks: *E. poecilonotus* is one of 4 deep-water groupers (the *E. morrhua* species-complex) that are characterized by having the body depth less than head length, caudal fin convex or rounded, 2 to 5 large spines at corner of preopercle, adults with 2 rows of teeth at sides of lower jaw, dorsal-fin rays 13 to 15, pectoral fins not fleshy, pelvic-fin length contained 2.0 to 2.8 times in head length, lateral-line scales 54 to 66, no auxiliary scales on body, and the colour pattern dominated by curving dark bands or longitudinal series of dark spots. The other 3 species of this species complex are *E. morrhua*, *E. radiatus*, and *E. tuamotuensis*. These 4 species have often been confused, and we can find no meristic or morphological characters that will distinguish them. Juveniles are readily identified by their colour patterns, but in large adults these distinctive markings are less obvious. (See **Key to Species**, colour descriptions and illustrations of each species for details.)

E. morrhua has a dark blotch at base of fifth to ninth dorsal-fin spines connected by a dark band to the upper edge of operculum. J.L.B. Smith (1958) confused *E. morrhua* with *E. poecilonotus*; his fig. A is of a 33 cm total length *E. morrhua* from Mozambique and his fig. B (reproduced as *E. morrhua* in Heemstra and Randall, 1986: fig. 166.53) is a 55 cm total length *E. poecilonotus* from Kenya.

Juveniles of *E. radiatus* have 5 irregular, solid, dark brown bands (with age only the edges remain dark) that run down and forward from dorsal edge of body, the first from nape to eye, the second from base of middle dorsal-fin spines to upper end of gill opening, the third and fourth dark bands from anterior and posterior dorsal-fin rays, both branching as they pass ventrally, and the last dark band on caudal peduncle; with growth, the dark bands break into spots and disappear ventrally on adults; soft dorsal fin and dorsal part of caudal fin densely spotted.

E. tuamotuensis has the dark bands on head and body forming a coarse reticulum that does not extend to the ventral part of body.

Epinephelus polylepis Randall and Heemstra, 1991

Fig. 383; Pl. XXE

SERRAN Epin 88

Epinephelus polylepis Randall and Heemstra, 1991:226, pl. 19c, figs 118-119 (type locality: Persian Gulf, off Bahrain).

Synonyms: ***Epinephelus chlorostigma*** (non Valenciennes): Boulenger, 1895:203 (in part; Muscat, Oman); Blegvad, 1944:83 (Stiffe Bank, Persian Gulf); Kotthaus, 1970:44, fig. 219 (WSW of Bombay); Randall et al., 1978:174, pl. 62 (Bahrain); Sivasubramaniam and Ibrahim, 1982:58, fig. (Qatar); Al-Baharna, 1986:227, fig. (Bahrain); Kuronuma and Abe, 1986:86, pl. 8 (Kuwait City market). ***Epinephelus*** sp. Randall, 1987a:109, 113 (Gulf of Aden to India).

FAO Names: **En** - Smallscaled grouper; **Fr** - Mérou petites écailles; **Sp** - Mero escamoso.

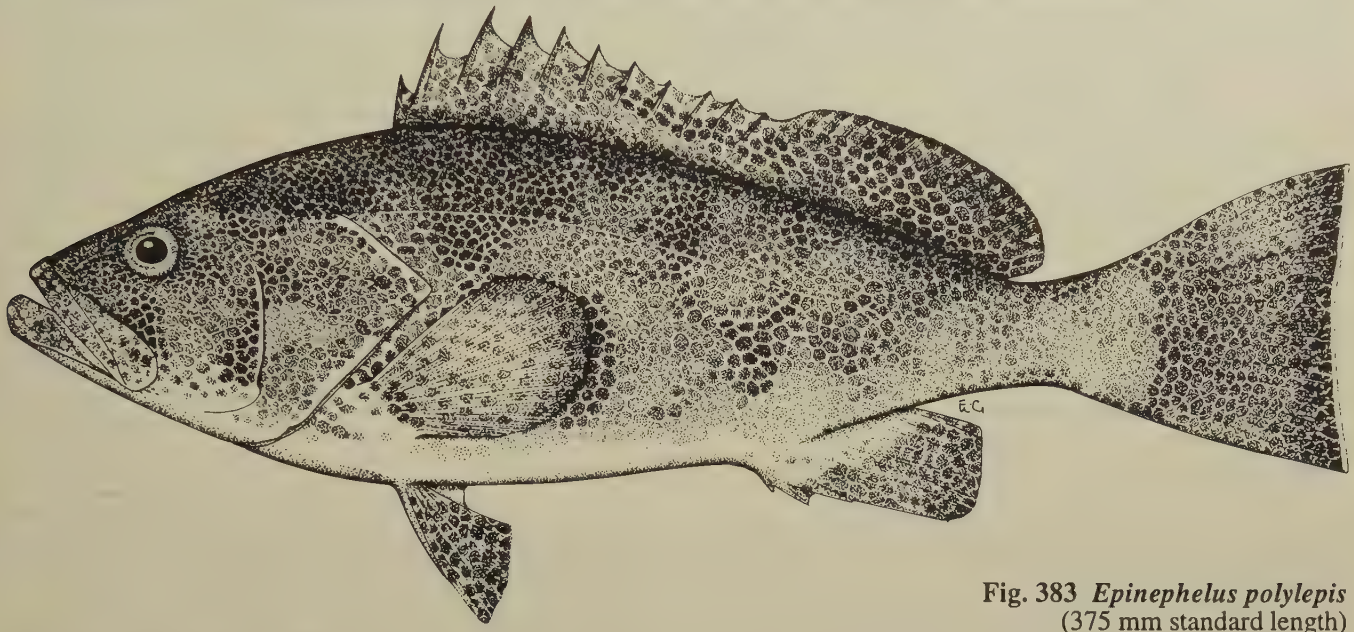


Fig. 383 ***Epinephelus polylepis***
(375 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 3.3 times in standard length (for fish 14 to 45 cm standard length); body width contained 1.8 to 2.4 times in the depth. Head length contained 2.5 to 2.8 times in standard length; interorbital slightly convex, the dorsal head profile almost straight; preopercle angular, with an indentation above the corner and enlarged serrae below the indentation; upper edge of operculum straight; rear nostrils slightly larger than front ones; maxilla reaches to below rear half of eye; a pair of small fixed canines at front of jaws; midlateral part of lower jaw with 2 rows of teeth, the inner ones twice length of outer teeth. Gill rakers 9 or 10 on upper limb, 17 or 18 on lower limb, 25 to 28 total. Dorsal fin with XI spines and 17 (rarely 16) rays, the third or fourth spine longest, its length contained 2.5 to 2.9 times in head length, the anterior interspinous membranes moderately incised; anal fin rounded or slightly angular, with III spines and 8 rays, the second or third ray longest, its length contained 2.1 to 2.5 times in head length; pectoral fins not fleshy, with 18 or 19 rays; pectoral-fin length contained 1.6 to 2.0, pelvic-fin length contained 1.9 to 2.4 times in head length; caudal-peduncle depth contained 3.2 to 3.7 times in head length; caudal fin truncate or slightly emarginate. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 65 to 72; lateral-scale series 126 to 137. Pyloric caeca 28 to 34. **Colour**: Head, body, and fins pale, covered (except ventral parts of head and body) with numerous small close-set dark brown spots; spots on fins and dorsal parts of head and body smaller and closer together than those on sides and ventrally. Rear edge of caudal fin with white line and row of blackish brown spots. Dark maxillary streak present.

Geographical Distribution: *E. polylepis* is at present known only from the northwest Indian Ocean (Gulf of Aden, Gulf of Oman, Persian Gulf, Pakistan, and west coast of India) (Fig. 384). Since this species has only recently been discovered, it may be expected to have a wider distribution.

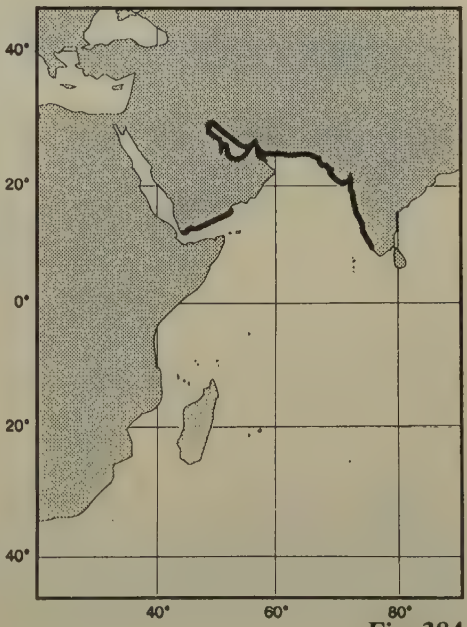


Fig. 384

Habitat and Biology: All of the specimens with habitat data were collected with trawls in depths of 33 to 100 m. Nothing has been published on the biology of this species.

Size: Attains at least 51 cm standard length; 61 cm total length (data from a photograph supplied by Gabriella Bianchi). The female holotype, 44 cm standard length, weighed 2.1 kg when fresh.

Interest to Fisheries: *E. polylepis* was found to be common in the Persian Sea off Oman in November 1983 (G. Bianchi, personal communication).

Local Names: IRAN: Somman.

Literature: Randall and Heemstra (1991); see also references listed under "Synonyms" (above).

Remarks: ***E. polylepis*** was previously misidentified as ***E. chlorostigma***, which is very similar and appears to be mostly allopatric (the only locality where both species have been recorded is Aden in the Gulf of Aden). ***E. chlorostigma*** differs in having fewer scales (lateral line 48 to 53, lateral-scale series 96 to 122) and a more pointed anal fin in adults (fourth or fifth ray longest, its length contained 1.9 to 2.3 times in head length).

E. gabriellae, the third species of the ***E. chlorostigma*** species-complex, appears to be sympatric with ***E. polylepis*** in the Gulf of Aden and along the south coast of Oman. It differs from ***E. polylepis*** in having fewer scales (lateral line 52 to 54, lateral-scale series 106 to 126), fewer dorsal-fin rays (14 or 15), more pyloric caeca (about 76), more elongate body (depth contained 3.2 to 3.6 times in standard length), and the caudal fin is more concave in adults (concavity 5 to 15 times in head length).

Epinephelus polyphekadion (Bleeker, 1849) Fig. 385; Pl. XXF SERRAN Epin 41

Serranus polyphekadion Bleeker, 1849:39 (type locality: Jakarta).

Synonyms: ***Serranus Goldmanni*** Bleeker, 1855d:434 (type locality: Obi Islands, Moluccas). ***Serranus microdon*** Bleeker, 1856b:86 (type locality: Ora Malang, southeast Java). ***Serranus dispar*** variety b Playfair in Playfair and Günther, 1867:6, pl. 1, fig. 3 (type locality: Zanzibar).

FAO Names: **En** - Camouflage grouper; **Fr** - Merou camouflage; **Sp** - Mero disfrazado.

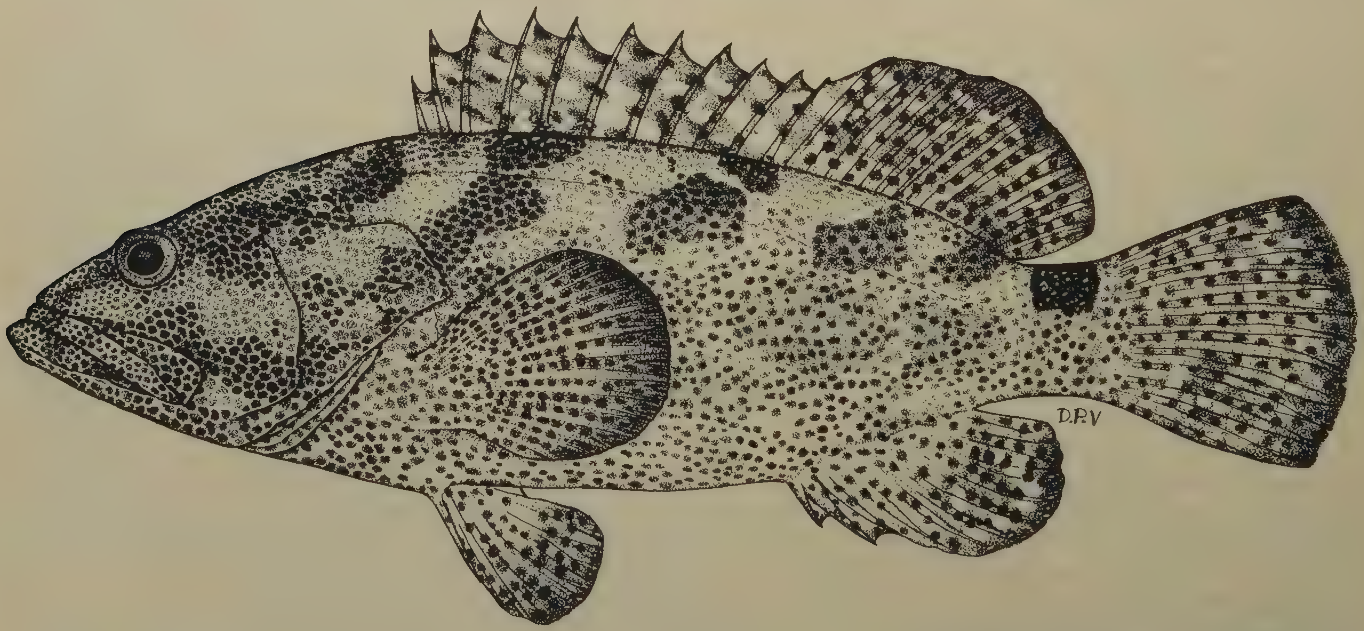


Fig. 385 ***Epinephelus polyphekadion*** (292 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.1 times in standard length (for fish 11 to 41 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat, the dorsal head profile evenly convex; preopercle rounded, the serrae at corner slightly enlarged; upper edge of operculum very convex; rear nostril diameter about twice diameter of front nostrils; maxilla reaches to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth; fixed canines at front of jaws inconspicuous. Gill rakers 8 to 10 on upper limb, 15 to 17 on lower limb, total 24 to 27. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.7 to 3.3 times in head length and distinctly shorter than longest dorsal-fin ray, the interspinous membranes moderately incised; anal fin with III spines and 8 rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.7 to 2.1 times, pelvic-fin length contained 1.9 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales. Lateral-line scales 47 to 52; lateral-scale series 95 to 113. **Colour**: Head, body, and fins pale brown, covered with numerous small dark brown spots; head and body with irregular dark blotches (more distinct on live specimens) superimposed over the dark spots; prominent black saddle blotch on caudal peduncle; dark spots extend all over head, including lower jaw, lips, branchiostegal membranes, gular area, and inside of mouth; numerous small white spots on fins (more distinct on live fish) and a few on head and body. Juveniles with a pair of blackish spots on each side of snout and a black spot at margin of second and third interspinous dorsal-fin membranes.

Geographical Distribution: *E. polyphekadion* is widely distributed in the tropical and subtropical Indo-West Pacific region from the Red Sea and east coast of Africa to French Polynesia. In the western Pacific it ranges from southern Japan to southern Queensland and Lord Howe Island. We have examined specimens from the Red Sea, Mozambique, Zanzibar, Bassas da India (Mozambique Channel), Madagascar, St. Brandon's Shoals, Seychelles, India, Cocos-Keeling Islands, Western Australia, Indonesia, Philippines, Ryukyu Islands, Ogasawara Islands, Palau Islands, Caroline Islands, Solomon Islands, Great Barrier Reef, Lord Howe Island, New Caledonia, Marshall Islands, Gilbert Islands, Ellice Islands, Fiji, Tonga, Line Islands, Rapa, Marquesas, and the Tuamotus. Additional reliable records are from Djibouti, Tanzania, Maldives, Chagos Islands, Papua New Guinea, New Ireland, Rotuma, Samoa, and Society Islands (Fig. 386).

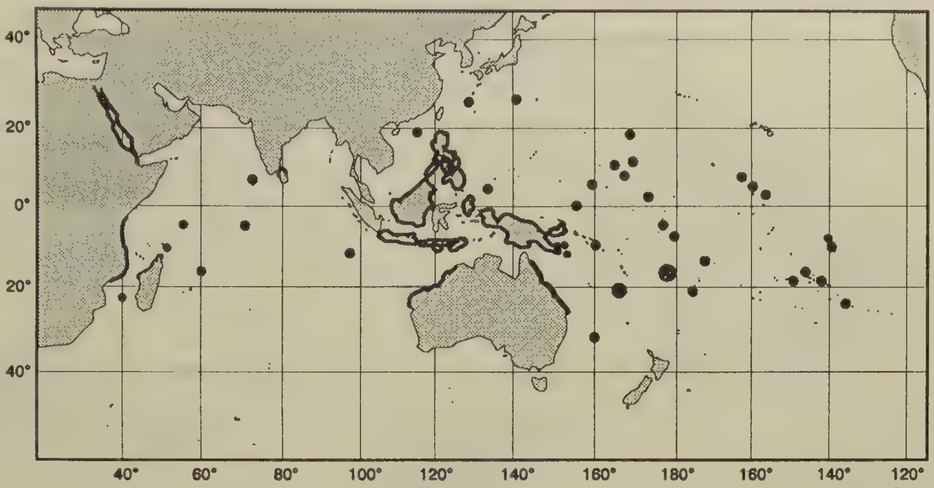


Fig. 386

Habitat and Biology: *E. polyphekadion* is almost always found in clear water on coral reefs, either in lagoons or on the outer reef; it is most abundant at islands, particularly atolls. It feeds mainly on crustaceans (primarily portunid crabs, but also some scyllarid and panularid lobsters) and fishes; gastropods and cephalopods are lesser important food items. Morgans (1959:647, as "*Epinephelus dispar*"), studying the population off Kenya, reported that females are mature at 38 cm standard length, males at about 42 cm standard length, and spawning occurs in January and February. Caillart and Morize (1989) used oxytetracycline as a marker to study the rate of microstriae deposition in the otoliths of 14 captive adults; they found that usually one microstria was deposited every 2 days, but that the frequency varies among fish. *E. polyphekadion* is probably the grouper species that is the least wary of divers, hence it is uncommon at localities with heavy spearfishing.

Size: Attains at least 61 cm standard length (75 cm total length) and a weight of 4 kg.

Interest to Fisheries: *E. polyphekadion* was formerly common in the markets of Zanzibar and probably throughout its range. It is of considerable importance in the artisanal fisheries of the tropical Indo-Pacific region, but occasionally implicated in cases of ciguatera fish poisonings. Recently, the aquaculture industry of Singapore has become interested in the culture of this species (which is known locally as the "marble grouper"). Caught with hook-and-line, spears, and traps.

Local Names: AUSTRALIA: Small-toothed rockcod; GAMBIER ISLANDS: Hapuku; JAPAN: Madarahata; MARQUESAS: Haoa; NEW CALEDONIA: Loche crasseuse; SINGAPORE: Marble grouper; TAHITI: Hapuu; TUAMOTUS: Kito.

Literature: Randall and Heemstra (1991).

Remarks: *E. polyphekadion* is the valid name for the species that most recent authors have identified as *E. microdon*. This species has often been confused with *E. fuscoguttatus*, which has a similar colour pattern of irregular dark blotches superimposed on numerous small dark brown spots and a black saddle blotch on the peduncle. But *E. fuscoguttatus* has 18 to 20 pectoral-fin rays, 28 to 31 gill rakers, a distinct indentation in dorsal head profile above the eyes, and rear nostril diameter of adults 4 to 8 times front nostrils.

Epinephelus polystigma (Bleeker, 1853)

Fig. 387; Pl. XXIA

SERRAN Epin 89

Serranus polystigma Bleeker, 1853a:244 (type localities: "Benculen, Sumatra" [= ?Bengkulu, Sumatera] and Ambon, Indonesia).

Synonyms: *Serranus australis* Castelnau, 1875:7 (type locality: Cape York, Queensland, Australia). *Epinephelus rahanus* Popta, 1918:1 (type locality: Raha, Muna, Sulawesi [Celebes], Indonesia).

FAO Names: **En** - White-dotted grouper; **Fr** - Mérou points blancs; **Sp** - Mero punteado blanco.

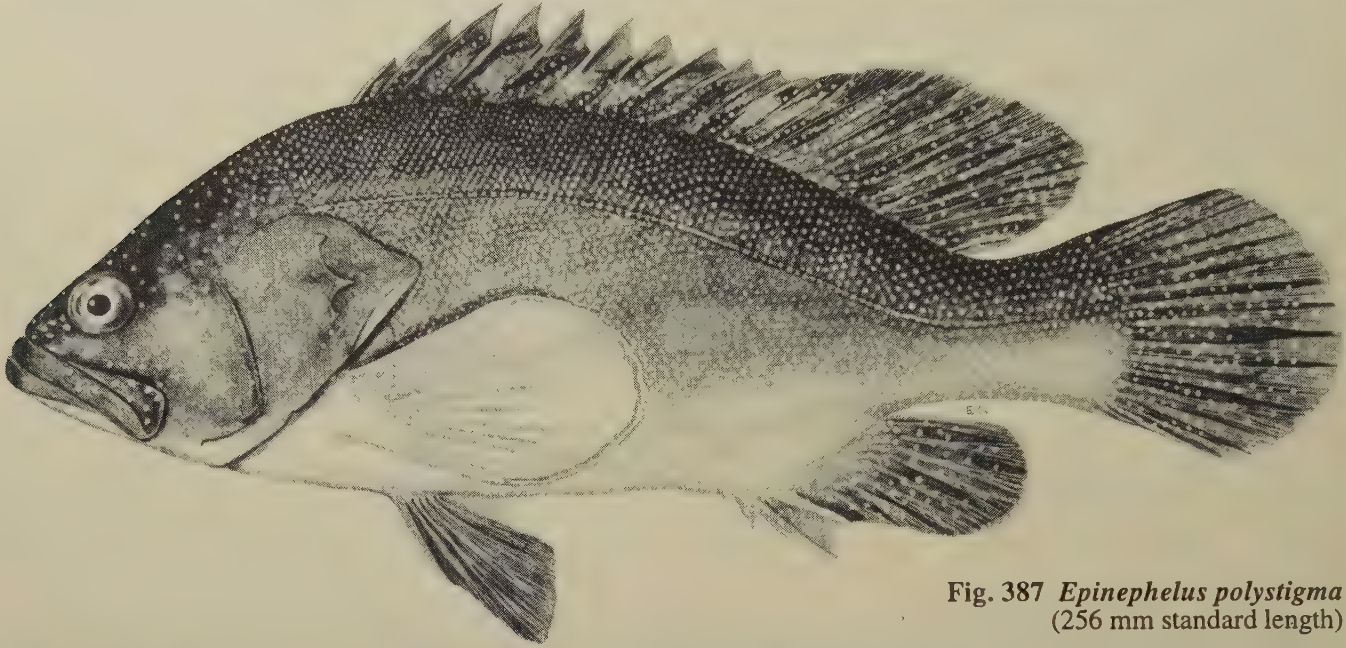


Fig. 387 *Epinephelus polystigma* (256 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 2.9 times in standard length (for fish 10 to 38 cm standard length). Head length contained 2.3 to 2.7 times in standard length; interorbital area flat; snout short, its length subequal to eye diameter; preorbital depth less than greatest width of upper lip; preopercle rounded, finely serrate, the serrae at corner slightly enlarged; upper edge of operculum mostly straight; anterior nostrils funnel shaped, the rear margin expanded as a flap reaching rear nostril; rear nostril diameter 2 to 4 times larger than front nostril diameter; maxilla reaches past vertical at rear edge of eye, the lower edge with a rounded step at front of widest part; midlateral part of lower jaw with 2 or 3 rows of small subequal teeth; 2 short stout canines at front of both jaws. Gill rakers shorter than gill filaments, 8 or 9 on upper limb, 13 to 16 on lower limb, total 21 to 24. Dorsal fin with XI spines and 15 or 16 rays, the third or fourth spine longest, its length contained 2.7 to 3.3 times in head length and distinctly shorter than longest dorsal-fin rays, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.6 to 1.8 times, pelvic-fin length contained 2.0 to 2.2 times in head length; caudal fin well rounded. Lateral-body scales ctenoid, with auxiliary scales. Lateral-line scales 49 to 55; lateral-scale series 81 to 91. Pyloric caeca 8. **Colour**: Head, body, and fins dark brown, covered (except on pelvic fins) with white or pale yellow dots (dots may be absent in preserved specimens); soft dorsal, anal, caudal, and pectoral fins with a narrow orange-red margin. Juveniles (8 or 9 cm standard length) with some larger, dark-edged, round or horizontally elongate, white spots on body (in addition to white dots); a smaller juvenile (22 mm standard length) taken in the same collection has dark-edged white spots, as large or larger than pupil, in about 3 irregular rows on body.

Geographical Distribution: *E. polystigma* is known only from the western Pacific: Indonesia, Philippines, Papua New Guinea, New Ireland, and the Solomon Islands (Fig. 388).

Habitat and Biology: This species is known only from brackish or freshwater areas; the usual habitat seems to be mangrove areas. A 19 cm standard length specimen from the Philippines is a ripe female.

Size: Attains at least 38 cm standard length (48 cm total length).

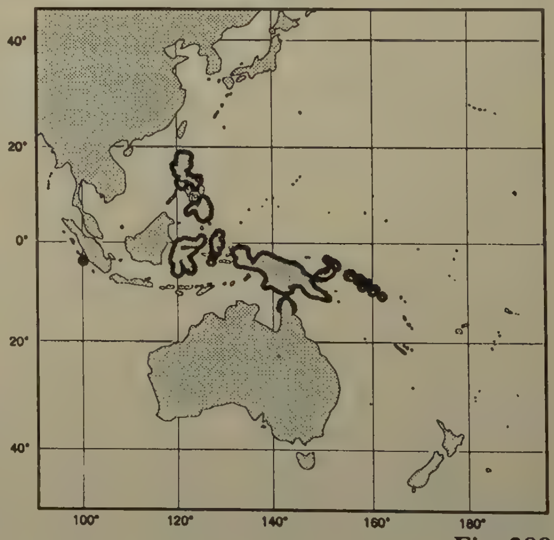


Fig. 388

Interest to Fisheries: *E. polystigma* seems to be a rare species; consequently, it is of little interest to fisheries. Caught with hook-and-line, spears, and traps.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: This species appears to be closely related to *E. caeruleopunctatus*, which also has a short snout, narrow preorbital, wide upper lip, upper edge of operculum sinuous or slightly convex, enlarged rear nostrils, high soft dorsal fin, and similar meristic characters. These two species differ somewhat in colour patterns: the white spots of *E. caeruleopunctatus* are larger and more disparate in size, and the small spots are often overlain with large pale blotches; also most specimens show an oblique black saddle blotch on rear half of peduncle and 4 or 5 faint dark blotches on body at base of dorsal fin; large adults (over 40 cm standard length) are brownish, covered with indistinct, contiguous, small pale spots.

Epinephelus posteli Fourmanoir and Crosnier, 1964 Fig. 389; Pl. XXIB SERRAN Epin 48

Epinephelus posteli Fourmanoir and Crosnier, 1964:18, pl. 14, fig. C (type locality: vicinity of Fort Dauphin, Madagascar).

Synonyms: None.

FAO Names: **En** - Striped-fin grouper (formerly: Tiger grouper); **Fr** - Mérou aile zébrée (formerly: Mérou tigre); **Sp** - Mero aleta listada (formerly: Mero tigre).

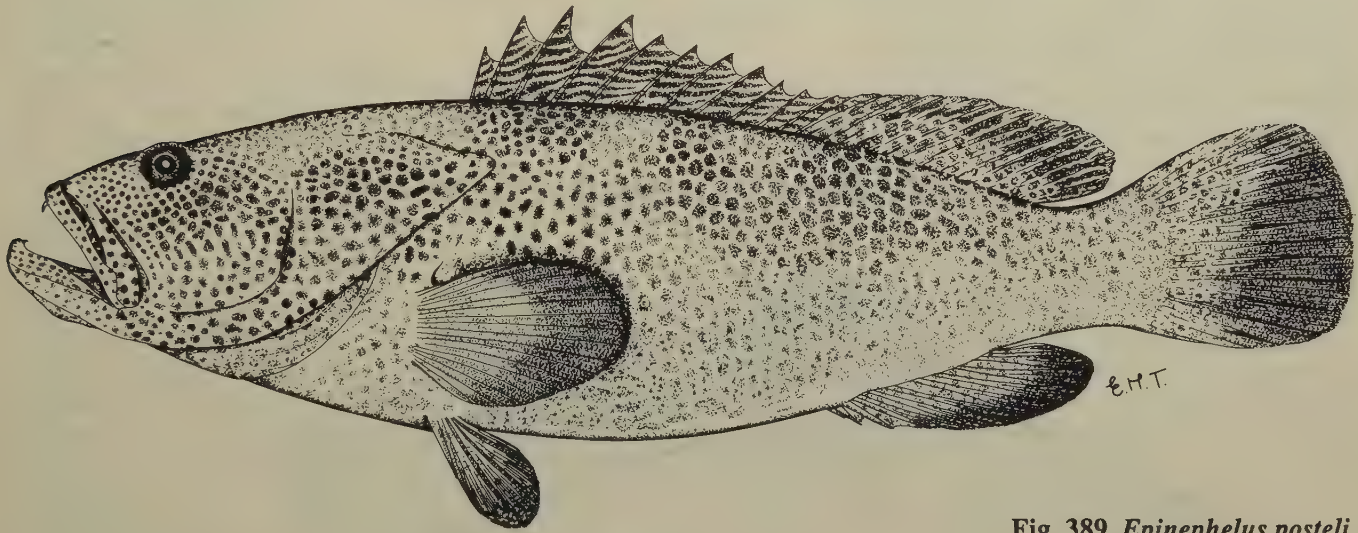


Fig. 389 *Epinephelus posteli*
(670 mm standard length)

Diagnostic Features: Body depth contained 3.1 to 3.5 times in standard length (4 specimens, 48 to 67 cm standard length); body width contained 1.7 to 2.0 times in the depth. Head length contained 2.3 to 2.4 times in standard length; interorbital width contained 5.9 to 6.8 times in head length; interorbital area concave; preopercle rounded, finely serrate, with a shallow indentation just above corner; upper edge of operculum almost straight; opercular spines inconspicuous; nostrils subequal; maxilla not reaching past eye; a pair of large, curved, fixed canines (their length equal to half eye diameter) at front of upper jaw and a pair of similar but slightly smaller canines at front of lower jaw; lateral part of both jaws with an outer row of 8 or 9 slightly smaller fixed canines and an inner row of smaller, more slender, depressible teeth. Gill rakers 7 or 8 on upper limb (of which 7 are rudiments); 10 to 15 on lower limb (including 6 to 10 rudiments). Dorsal fin with XI spines and 15 or 16 rays, the third to fifth spines usually longest, their length contained 3.3 to 3.6 times in head length and shorter than the longest dorsal-fin rays, the interspinous membranes deeply incised; anal fin with III spines and 9 rays; pectoral-fin rays 18; pectoral-fin length contained 1.9 to 2.2 times, pelvic-fin length contained 2.6 to 2.8 times in head length; caudal fin rounded. Lateral-body scales smooth, mostly embedded, and covered with tiny auxiliary scales; lateral-line scales difficult to count (about 59 to 64); lateral-scales series also difficult to count (about 98 to 108). **Colour**: Head and body covered with small, irregular, close-set dark red or reddish brown spots, the pale interspaces forming an irregular pale network pattern; dark spots run in rows paralleling the fin rays of soft dorsal and caudal fins; interspinous membranes of dorsal fin with several horizontal dark streaks; live fish with 4 narrow, irregular, oblique, pale bars running down and forward on body; dark spots of some rows on distal part of caudal and soft dorsal fins of some fish merge to form dark streaks running along or between the fin rays; soft dorsal, caudal, anal, and paired fins generally darker than body.

Geographical Distribution: *E. posteli* is known only from Madagascar, South Africa (Natal), and southern Mozambique (Fig. 390).

Habitat and Biology: Coral reefs in depths of 20 to 50 m. The testes of a 61 cm standard length specimen contained a central lumen and numerous "brown bodies" along the lateral edges of the gonadal lamellae.

Size: Attains at least 67 cm standard length (81 cm total length) and a weight of 8.6 kg.

Interest to Fisheries: *E. posteli* appears to be rare, but it is of some importance to South African sport fishermen along the northern coast of a Natal. Caught with hook-and-line and spear.

Local Names:

Literature: Heemstra and Randall (1986); Randall and Heemstra (1991).

Remarks: This distinctive species is not closely related to the other reticulated species of *Epinephelus* (*E. hexagonatus* et al.). The teeth in the jaws are larger than any other species of the genus, except *E. bruneus*.

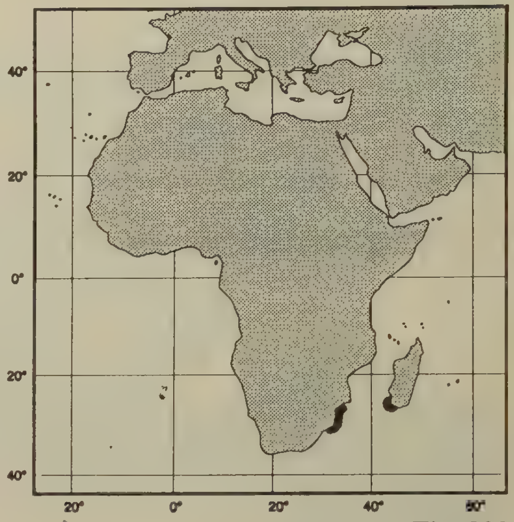


Fig. 390

Epinephelus quernus Seale, 1901

Fig. 391; Pl. XXIC

SERRAN Epin 90

Epinephelus quernus Seale, 1901:3, fig. 1 (type locality: Honolulu).

Synonyms: None.

FAO Names: **En** - Hawaiian grouper; **Fr** - Mérou hawaiien; **Sp** - Mero hawaiano.

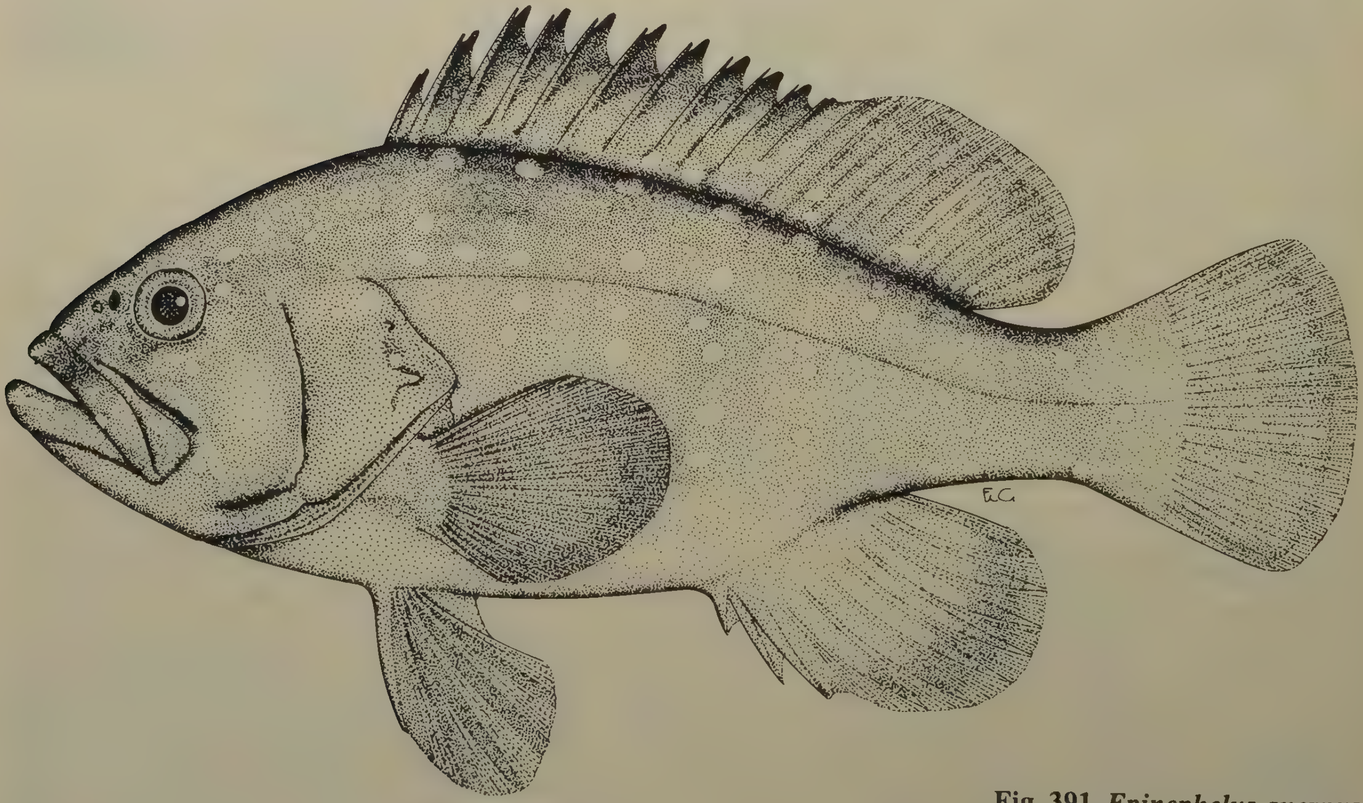


Fig. 391 *Epinephelus quernus*
(194 mm standard length)

Diagnostic Features: Body depth contained 2.3 to 2.7 times in standard length (for fish 10 to 39 cm standard length); body width contained 2.0 to 2.5 times in the depth. Head length contained 2.3 to 2.5 times in standard length; interorbital area convex, the width subequal to eye diameter for fish 10 to 20 cm standard length; preopercle subangular, the corner with 3 to 5 enlarged serrae, the lowest directed ventrally; ventral edge of preopercle fleshy, without serrae; edge of interopercle and subopercle smooth or with a few serrae; upper edge of operculum convex; rear nostrils of adults ovate and enlarged, its greatest diameter 2 to 4 times larger than diameter of front nostrils. Gill rakers 8 or 9 on upper limb, 15 or 16 on lower limb, total 23 to 24. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.4 to 3.1 times in head length and slightly shorter than the longest dorsal-fin rays; interspinous dorsal-fin membranes deeply incised; anal fin with III spines and 9 rays; pectoral-fin rays 19 or 20; pelvic-fin origin below base of pectoral fin; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.7 to 2.1 times in head length; caudal fin rounded. Midlateral-body scales ctenoid, with auxiliary scales; lateral-line scales 66 to 73; lateral-scale series 122 to 142. Pyloric caeca numerous; 101 counted on a 16 cm standard length specimen. **Colour**: Juveniles greyish brown to dark brown, with 8 vertical series of white spots on body; adults dark brown with the same vertical series of white spots, but they are less distinct and obscured by numerous additional pale spots and blotches of variable size; fins mostly unspotted and coloured like body, except for a few pale spots on basal part of dorsal fin.

Geographical Distribution: *E. quernus* is endemic to the Hawaiian Islands and Johnston Island (Fig. 392).

Habitat and Biology: Depth range 20 to 380 m; adults usually found in deeper water. Seki (1984) found that *E. quernus* feeds mainly on fishes, with crustaceans (mainly shrimps) as the next most common prey.

Size: Attains at least 80 cm total length and a weight of 10 kg.

Interest to Fisheries: In 1984 the commercial landings for *E. quernus* comprised 25 metric tons (6% of the deepwater bottom fishes landings) for the main Hawaiian Islands (Polovina, 1987).

Local Names: HAWAII: Hapuupuu.

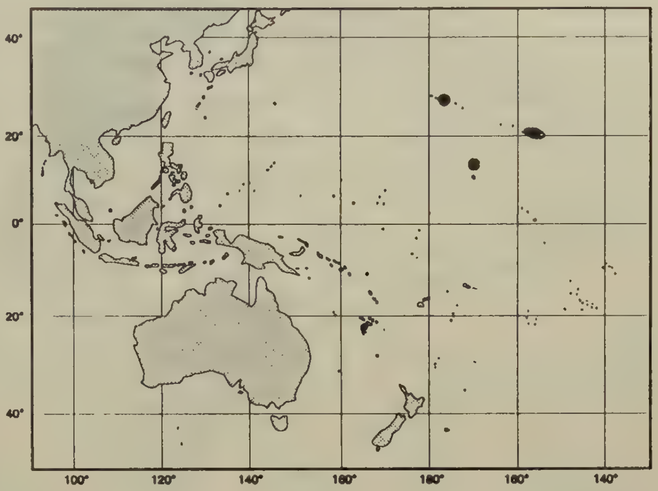


Fig. 392

Literature: Randall and Heemstra (1991).

Remarks: *E. quernus* appears to be closely related to *E. niphobles* of the Eastern Pacific, which has similar meristic characters (except for fewer lateral-scale series, 100 to 106), deep body, enlarged posterior nostrils, deeply incised spinous dorsal-fin membranes, and juveniles dark reddish brown with white spots in a grid-like pattern of vertical series and horizontal rows on body and dorsal fin. *E. niphobles* adults differ from *E. quernus* in having a truncate caudal fin, the second dorsal-fin spine longest, and a uniform dark brown colour pattern without white spots.

Epinephelus quoyanus (Valenciennes, 1830)

Fig. 393; Pl. XXID

SERRAN Epin 10

Serranus Quoyanus Valenciennes in Cuv. and Val., 1830:519 (type locality: New Guinea).

Synonyms: *Serranus Gilberti* Richardson, 1842:19 (type locality: Port Essington, Northern Territory, Australia). *Serranus megachir* Richardson, 1846:230 (type locality: coasts of China). *Serranus pardalis* Bleeker, 1849:37 (type locality: Sumbawa, Indonesia). *Perca melanocelidota* Gronovius, 1854:110 (type locality: "Indian Ocean"). *Serranus alatus* Alleyne and Macleay, 1877:264, pl. 4, fig. 2 (type locality: Hall Sound, New Guinea). *Serranus carniatus* Alleyne and Macleay, 1877:265, pl.4, fig. 3 (type locality: Cape Grenville, Queensland, Australia). Often misidentified as *E. macrospilos* or *E. hexagonatus*.

FAO Names: **En** - Longfin grouper (formerly: Honycomb grouper); **Fr** - Mérou longues ailes; **Sp** - Mero aleta larga.

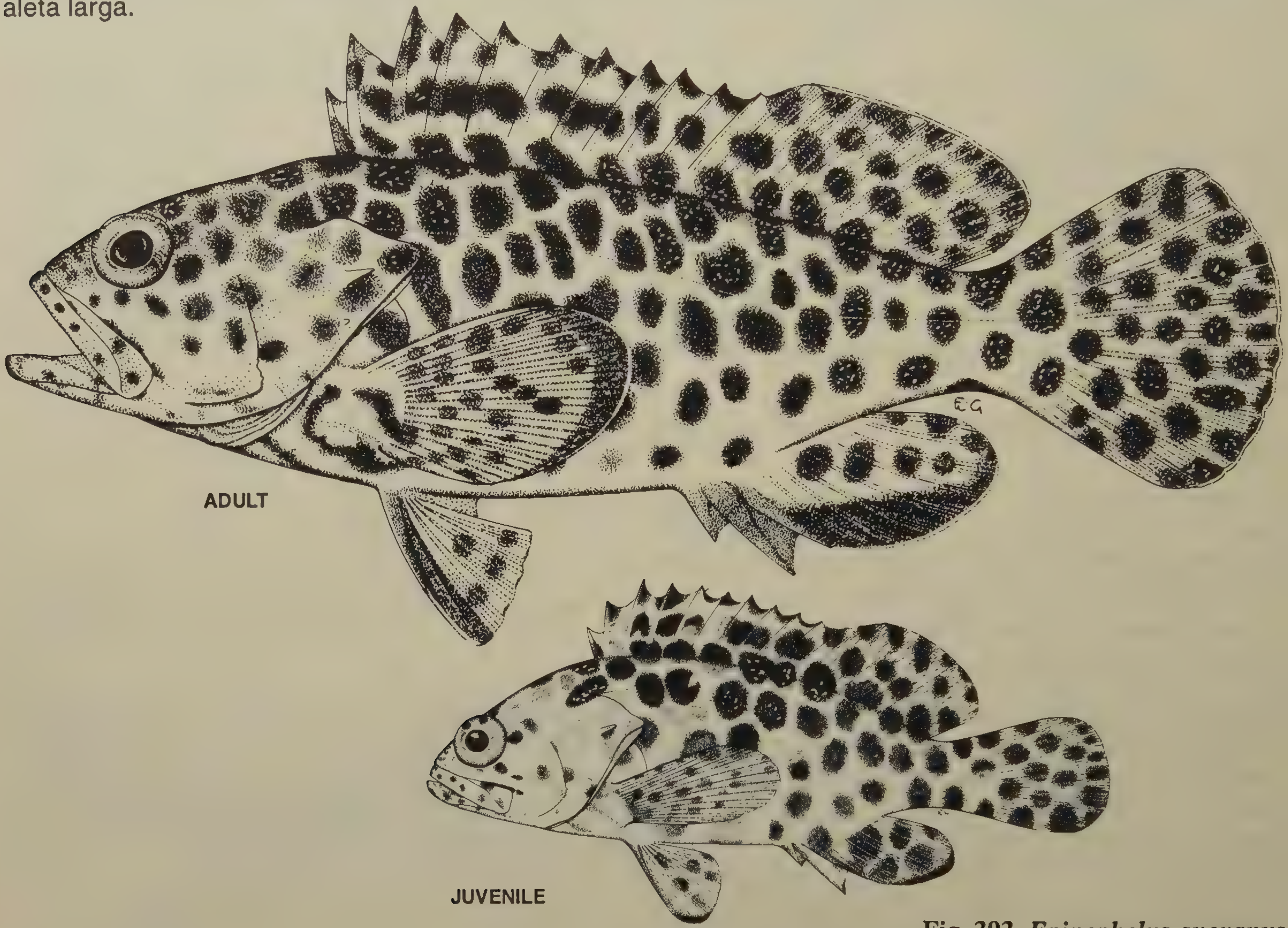


Fig. 393 *Epinephelus quoyanus*
(adult 140 mm standard length, juvenile 59 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.2 times in standard length (for fish 10 to 31 cm standard length). Head length contained 2.3 to 2.6 times in standard length; dorsal head profile evenly curved; snout subequal to eye diameter, snout length contained 4.6 to 5.3 times in head length; preopercle rounded or subangular; upper edge of operculum almost straight; posterior nostril diameter about twice that of anterior nostrils; maxilla reaches to or past vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of teeth; lower jaw barely projecting in front of upper jaw. Gill rakers 6 to 8 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 to 18 rays, the fourth spine usually longest, its length contained 2.3 to 3.0 times in head length and shorter than the longest dorsal-fin ray; anal fin with III spines and 8 rays, the second and third spines subequal, their length contained 2.8 to 3.8 times in head length and less than or subequal to depth of peduncle; pectoral-fin rays 17 to 19; pectoral-fin length 26 to 35% of standard length, contained 1.2 to 1.7 times in head length; pelvic-fin length 1.6 to 2.1 times in head length; caudal-peduncle depth contained 3.1 to 3.6 times in head length; caudal fin rounded; length of middle caudal-fin rays contained 1.35 to 2.0 times in head length. Lateral-body scales ctenoid; auxiliary scales present; lateral-line scales 48 to 52; lateral-scale series 80 to 96. Pyloric caeca 21. **Colour**: Head and body pale, mostly covered with large, close-set, hexagonal to roundish, dark brown spots (some spots reddish brown or black), dorsally the spots are so close together that the pale interspaces form a reticulum, but ventrally the spots are more separated and their margins more diffuse; similar dark spots on median fins;

chest with 2 dark brown bands that are confluent below pectoral-fin bases and nearly joined anteriorly at gill opening, thus isolating a large pale area on ventral part of chest and another pale area between upper dark band and dark blotch that usually covers most of pectoral-fin base; isthmus and ventral surface of chest with irregular dark brown bands and pale blotches; dark spots on head smaller anteriorly, but always 3 or 4 times larger than nostrils; a squarish unspotted white or pale area on cheek at rear end of maxilla; ventral edge of anal and caudal fins and leading edge of pelvic fins with white line and broad blackish submarginal band; pectoral fins mostly dusky with indistinct dark spots (more distinct in specimens from Australia). Colour pattern of small juveniles (3 to 10 cm standard length) is essentially similar to that of adults.

Geographical Distribution: *E. quoyanus* is a western Pacific species which occurs from southern Japan to Australia, including Taiwan, China, Hong Kong, Philippines, Viet Nam, Thailand, Indonesia, New Guinea and associated islands, and north coast of Australia (Western Australia to northern New South Wales [29°47'S]), including islands of the Great Barrier Reef (Fig. 394). Except for the record from the Andaman Islands (Day, 1875:13, pl. 2, fig. 2, misidentified as "*Serranus merra*"), this species is not known from the Indian Ocean. *E. quoyanus* is also not reported from the islands of Micronesia, Melanesia or the central Pacific.

Habitat and Biology: A sedentary little grouper, *E. quoyanus* is usually found on inshore silty reefs; we found no records from depths greater than 50 m. According to Chan (1968), this species (reported as *E. megachir*) feeds on crustaceans, fishes, and worms, and it is the second most common inshore grouper of the Hong Kong area. The enlarged fleshy pectoral fins of this species appear to be related to its habit of sitting on the substrate, with its pectoral fins in contact with the bottom.

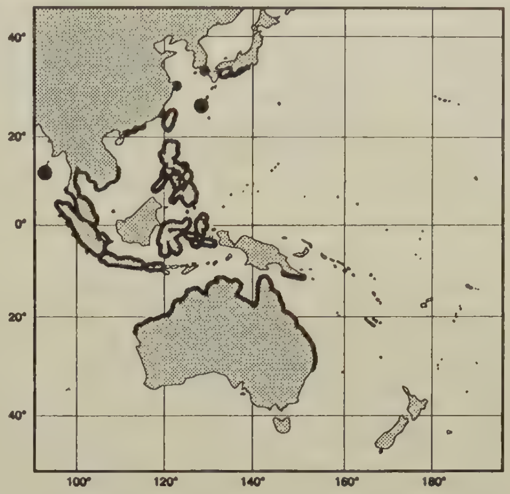


Fig. 394

Size: Maximum known 31 cm standard length.

Interest to Fisheries: *E. quoyanus* is of some economic importance in fisheries at Hong Kong and Taiwan (and probably at other places where it is common). In the Penghu Islands, Taiwan, it is the most common grouper species at the Makung market, and it is often sold alive. It is usually caught with gill nets and hand-lines.

Local Names: AUSTRALIA: Long-finned rock-cod; HONG KONG: Long-finned grouper; Gum-chin-paan, Fah-gau-paan, Fah-tau-mui; JAPAN: Moyôhata.

Literature: Randall and Heemstra (1991). Illustrations of *E. quoyanus* were published as "*Epinephelus megachir*" by Jordan and Richardson (1910:fig. 8; dark bars on chest mentioned in text, but not shown on figure); Katayama (1960:pl. 49; dark bars on chest mentioned in text, but not shown on figure; 1988:pl. 348, fig. G [same drawing published in 1960]); Chan (1968); Burgess and Axelrod (1974:figs 241, 242 and 245; 1976:figs 318-320); Grant (1975:240); Coleman (1981); and Shen (1984:fig. 289-18). It was misidentified as "*Epinephelus merra*" by Coleman (1974); Grant (1975:colour pl. 60); Schroeder (1980) and Shen (1984:fig. 289-19). *E. quoyanus* was illustrated under its correct name by Russell (1983); Sainsbury et al. (1985); Grant (1987); Allen and Swainston (1988).

Remarks: *E. quoyanus* is one of 9 shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These reticulated groupers have been much confused in the literature, and many museum specimens have been misidentified; the other species differ from *E. quoyanus* as follows:

E. bilobatus has 3 bilobed dark blotches or close-set pairs of dark brown spots on body at base of dorsal fin, pectoral fins with several small dark spots, no dark bands on chest, pectoral-fin length 1.5 to 1.8 times in head length.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), pectoral-fin length contained 1.7 to 2.2 times, pelvic-fin length contained 2.2 to 2.6 times, and caudal-peduncle depth contained 3.8 to 4.3 times in head length.

E. hexagonatus has conspicuous white dots on body between the dark spots and no dark bands on chest, length of second anal-fin spine distinctly longer than third anal-fin spine or depth of peduncle, lateral-line scales 61 to 70, and sides of lower jaw with 3 to 5 rows of teeth.

E. macrospilos has the lateral-body scales mostly smooth, no dark bands on chest, pectoral-fin length 1.5 to 2.0 times in head length, lower jaw distinctly projecting, and small juveniles (3 to 7 cm standard length) with a large black area covering two-thirds of caudal fin.

E. maculatus has the dorsal-fin membranes not incised between the spines, third or fourth dorsal-fin spine usually longer than dorsal-fin rays; and juveniles are yellowish brown, with well-separated small black spots mainly on head and fins and a few large white blotches on body and dorsal fin.

E. melanostigma has a single black blotch at base of last 4 dorsal-fin spines, no black bands on chest, body depth in head length 3.0 to 3.4 times in standard length, fourth to ninth dorsal-fin spines longest (their length contained 2.9 to 3.8 times in head length), and lateral-line scales 56 to 68.

E. merra has the pectoral fins covered with distinct small black spots largely confined to the rays, length of second anal-fin spine much longer than depth of caudal peduncle, and lateral-scale series 98 to 114.

E. spilotoceps has a large black blotch at base of last 4 dorsal-fin spines, 2 similar but smaller dark blotches at base of soft dorsal fin and a third small dark blotch on top of peduncle; it also has dark spots rather than dark bands on the chest, minute (nostril-sized) black spots on the snout, fewer dorsal-fin rays (14 to 16) and more lateral-line scales (59 to 69).

Epinephelus radiatus (Day, 1867)

Fig. 395; Pl. XXIE

SERRAN Epin 50

Serranus radiatus Day, 1867:699 (type locality: near Madras,India).

Synonyms: ***Epinephelus döderleinii*** Franz, 1910:35 (type localities, Yokahama and Zushi, Japan). Often misidentified as "***Epinephelus morrhua***."

FAO Names: **En** - Oblique-banded grouper; **Fr** - Mérou zébré; **Sp** - Mero acebrado.

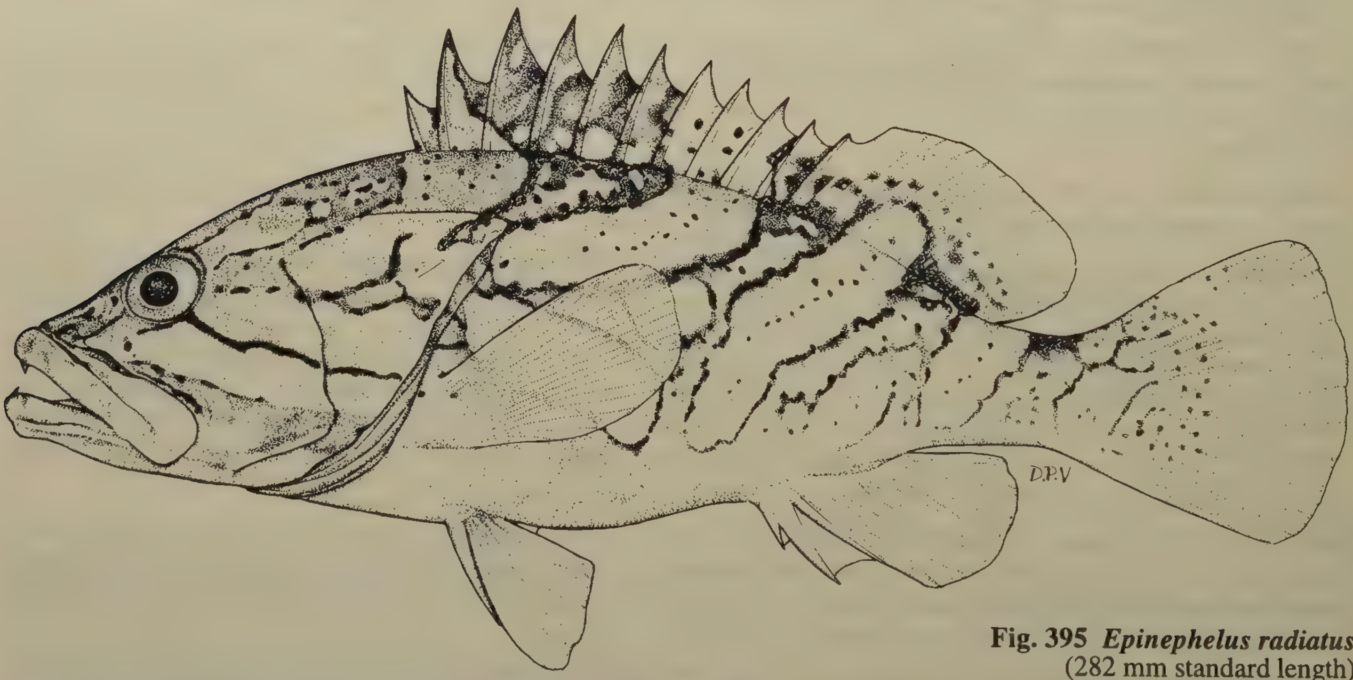


Fig. 395 ***Epinephelus radiatus*** (282 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 3.0 times in standard length (for fish 11 to 42 cm standard length). Head length contained 2.1 to 2.3 times in standard length; interorbital area nearly flat, the dorsal head profile slightly convex; preopercle angle with 2 to 5 distinctly enlarged serrae; upper edge of operculum almost straight; adults with rear nostril diameter 2 or 3 times that of front nostrils; maxilla reaches to or past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 or 9 on upper limb, 16 to 18 on lower limb, the longest gill raker distinctly shorter than the longest gill filaments. Dorsal fin with XI spines and 13 to 15 rays, the third spine longest, its length contained 2.6 to 3.0 times in head length and longer than the longest dorsal-fin ray, the interspinous membranes deeply incised; anal fin with III spines and 8 rays, the second and third spines subequal; pectoral-fin rays 17 or 18, the fin almost transparent; pectoral-fin length contained 1.7 to 2.2 times, pelvic-fin length contained 2.1 to 2.8 times in head length; caudal fin convex to moderately rounded. Lateral-body scales distinctly ctenoid, without auxiliary scales; lateral-line scales 52 to 66; lateral-scale series 102 to 120. **Colour**: Small adults (20 to 40 cm standard length) buff, with 5 oblique dark-edged pale bands as follows: first band from upper half of eye, curving and broadening on nape; second band branching from first band just behind eye, bifurcating on operculum, the upper branch continuing dorsally, broadening on body and extending even more broadly over middle of spinous dorsal fin; third band continued as lower branch of second band, curving dorsally from end of operculum and expanding at base of last 2 spines and first 3 or 4 rays of dorsal fin (this band with a ventral extension from an included pale circle covered by tip of pectoral fin); fourth band runs from rear end of dorsal fin, branching at midside, with one branch going towards anal-fin origin, the other to rear end of anal-fin base; fifth band on caudal peduncle (sometimes divided into 2 short branches at lower edge of peduncle); dark bands with scattered small black spots and pale blotches, especially dorsally; pale interspaces (between the dark bands) with small dark brown spots, mainly arranged in series along middle of interspaces; dark brown line from lower edge of eye to edge of subopercle; faint dark band along maxillary groove and continuing to edge of interopercle. Large adults (40 to 50 cm standard length) with dark-edged bands replaced by series of dark spots (except for dark line running posteriorly from lower edge of eye); no spots on ventral third of body; dorsal fin and most of caudal fin covered with small dark spots. Juveniles (10 to 20 cm standard length) dark brown with black-edged pale brown bands (= white markings on smaller fish) enclosing numerous small black spots. Small juveniles (4 to 7 cm standard length) are mostly dark greenish brown, with dark-edged immaculate white markings that represent the pale interspaces on larger specimens; fins translucent white, except for spinous dorsal fin which is coloured like the body.

Geographical Distribution: *E. radiatus* occurs from the Red Sea to Japan. We have examined specimens or seen photographs from the Red Sea, Aden, Réunion, Mauritius, Chagos, Gulf of Oman, India, Sri Lanka, northwestern Australia, Taiwan, Japan, Papua New Guinea, and Japan (Fig. 396). The Natal record that was reported by Heemstra and Randall (1986) is unsubstantiated.

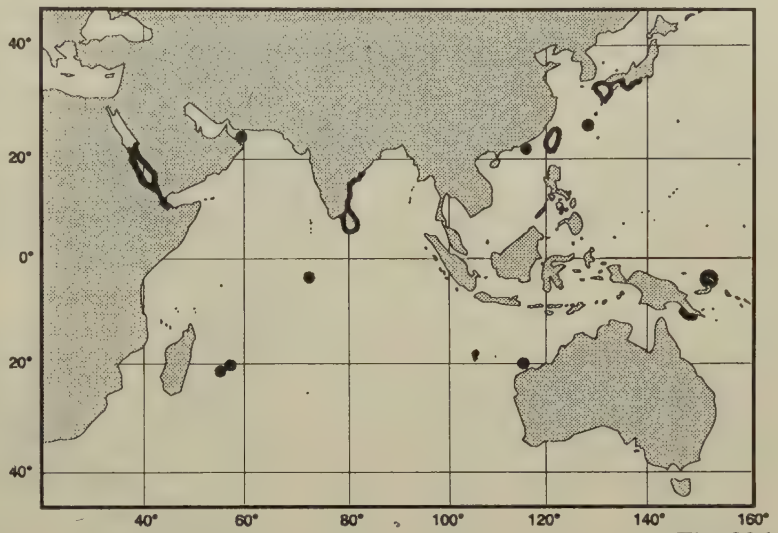


Fig. 396

Habitat and Biology: Adults of this deep-water species are known from depths of 80 to 383 m; juveniles have been found in 18 to 20 m. *E. radiatus* is apparently rare.

Size: Attains at least 57 cm standard length (about 70 cm total length).

Interest to Fisheries: Apparently of some commercial importance in Japan. Caught with handlines and vertical longlines.

Local Names: HONG KONG: Yau-paan; JAPAN: Kakehashihata; SRI LANKA: Raja laveya, Kallu kaleva.

Literature: Illustrations of *E. radiatus* have been published by Day (1875, as *Serranus morrhua*); Katayama (1960, as *E. morrhua*); Hiyama and Yasuda (1971, as *E. cometae*); Kyushin et al. (1977, as *E. morrhua*); Chang et al. (1979, as *E. morrhua*); Gloerfelt-Tarp and Kailola (1984); Sainsbury et al. (1985); Heemstra and Randall (1984, 1986); Randall and Klausewitz (1986); Shirai (1986, as *E. morrhua*); Kohno (1987, as *E. morrhua*); Allen and Swainston (1988); Katayama (1988); Lee (1990).

Remarks: Juveniles of *E. magniscuttis* show a pattern of dark spots on the head and body that is similar to the dark bands of juvenile *E. radiatus*; but *E. magniscuttis* lacks the solid dark lines or bands that are more or less developed on *E. radiatus* (at least a narrow one from lower edge of eye).

Epinephelus retouti Bleeker, 1868

Fig. 397; Pl. XXIF

SERRAN Epin 51

Epinephelus Retouti Bleeker, 1868:339 (type locality: Réunion).

Synonyms: *Epinephelus truncatus* Katayama, 1957:158, fig. 4 (type locality: Torishima, Izu Islands). *Epinephelus rubra* (non Bloch) Baissac, 1962:162 (*nomen nudum*). *Epinephelus mauritianus* Baissac, 1962:188 (type locality: Mauritius).

FAO Names: **En** - Red-tipped grouper (formerly: Brownback grouper); **Fr** - Mérou á bout rouge (formerly: Mérou rouge); **Sp** - Mero punteado.

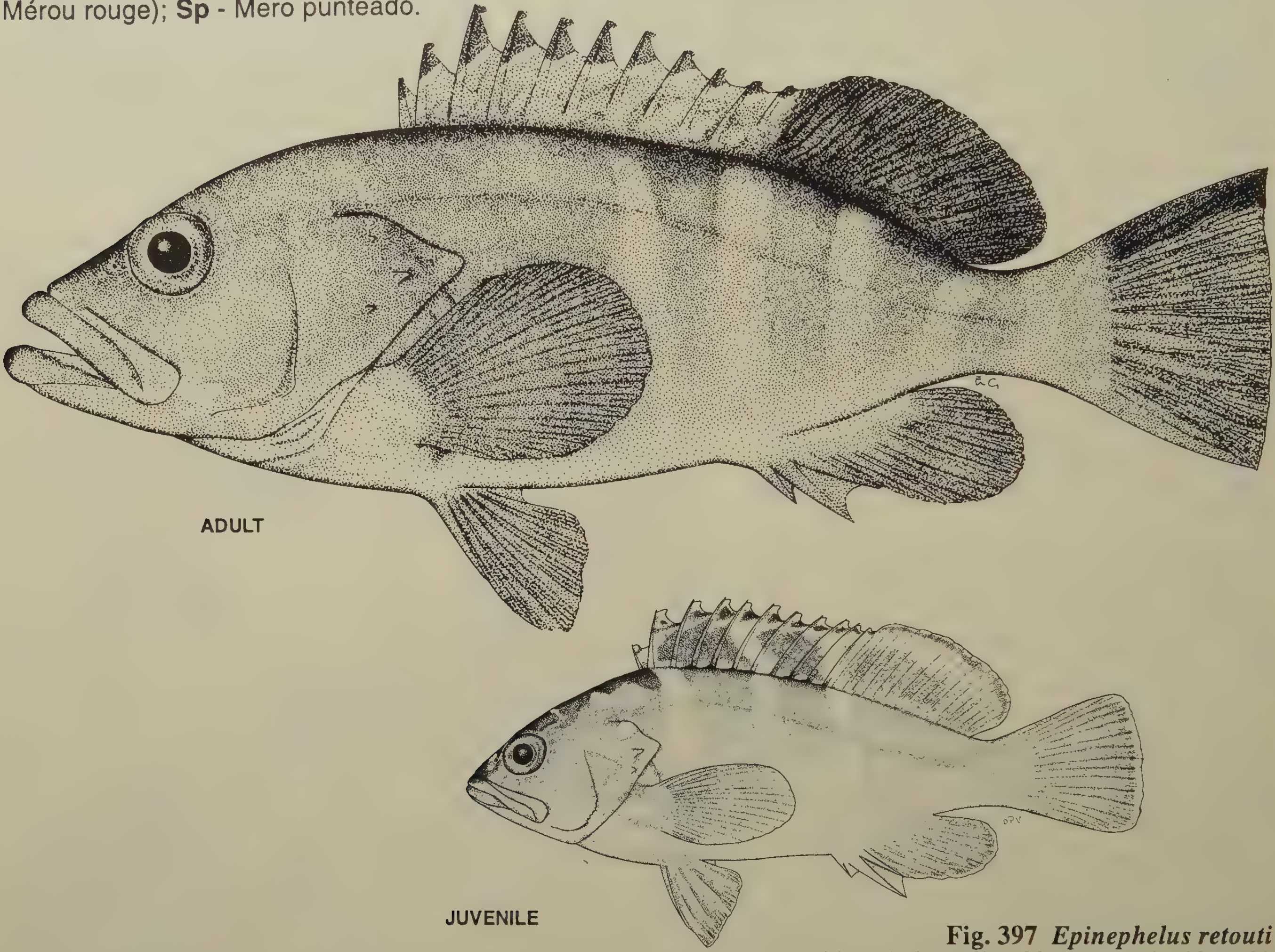


Fig. 397 *Epinephelus retouti*
(adult 286 mm standard length, juvenile 100 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 3.1 times in standard length (for fish 12 to 35 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital flat to slightly convex, the dorsal head profile slightly convex; preopercle rounded, finely serrate; upper edge of operculum sinuous; snout length contained 3.5 to 3.9 times in head length; nostrils subequal; maxilla reaches below rear half of eye; midlateral part of lower jaw with 3 or 4 rows of teeth; a pair of short fixed canines at front of both jaws. Gill rakers 6 to 8 on upper limb, 15 to 17 on lower limb, total 21 to 24. Dorsal fin with XI spines and 16 or 17 rays, the third to fifth spines longest, their length contained 2.4 to 3.1 times in head length; anal fin with III spines and 8 rays; pectoral fins fleshy, with 19 or 20 rays; pectoral-fin length contained 1.5 to 1.8 times, pelvic-fin length contained 1.8 to 2.2 times in head length; caudal fin truncate to slightly convex. Lateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 64 to 76; lateral-scale series 120 to 141. Pyloric caeca numerous (more than 40). **Colour**: Adults dull yellowish orange to brownish red, each scale on dorsolateral part of body with a dark greenish grey spot; usually 5 faint dark bars on body, the second and third bars extending onto spinous dorsal fin where they are dark brown; dorsal fin greenish brown, the soft-rayed part darker than the rest of fin, the outer triangular part of interspinous membranes dark red, set off from rest of fin by an orange-yellow stripe; dorsal-fin margin of caudal fin dark greenish brown; dark red or brown line along base of dorsal fin; orbit narrowly edged, except anteriorly, with dark red (pale in preservative); pale blue line adjacent to red rim of orbit and completely surrounding eye. Juveniles with dorsal part of first 3 dark bars on body black, the second and third bars extending into dorsal fin; dorsal part of head also black, with 4 irregular transverse whitish bands across dorsal surface.

Geographical Distribution: *E. retouti* is known from islands of the tropical Indo-Pacific region: Bassas da India (Mozambique Channel), Madagascar, Réunion, Mauritius, Chagos, Christmas Island (eastern Indian Ocean), Indonesia (Bali Sea off Lombok), Taiwan, Japan (Okinawa, Izu Islands), Palau, New Caledonia, Line Islands, American Samoa, Society Islands, and Tuamotu Islands (Fig. 398).

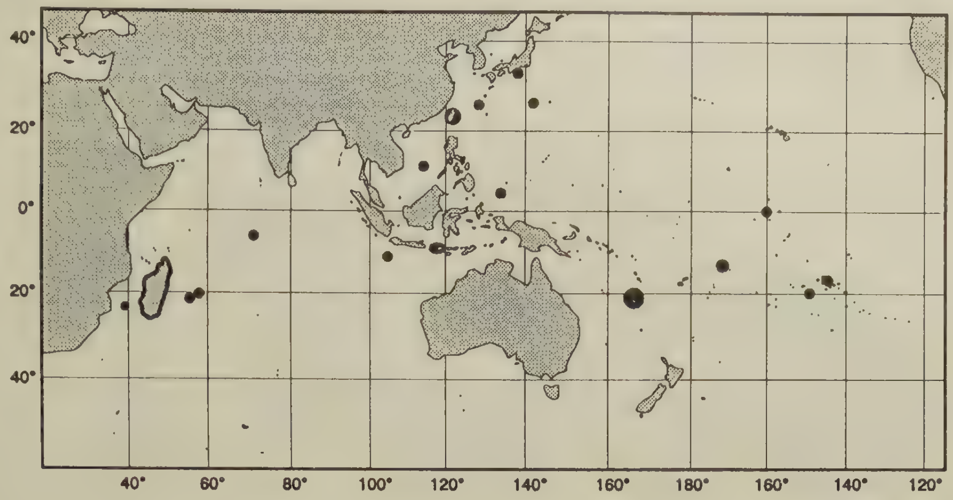


Fig. 398

Habitat and Biology: Adults are found on coral reefs and outer reef slopes in depths of 70 to 220 m; juveniles occur in depths of 20 to 40 m.

Size: According to Postel et al. (1963), *E. retouti* attains 50 cm total length and 2 kg in weight.

Interest to Fisheries: This species is too rare to be of commercial importance. It is caught with handlines and vertical longlines.

Local Names: JAPAN: Akahata-modok; MAURITIUS: Vieille rouge; NEW CALEDONIA: Loche rouge du large; REUNION: Rouge du large.

Literature: Randall and Heemstra (1991).

Remarks: *E. retouti* is a member of the *E. fasciatus* species-complex; the other 3 species of this complex are *E. fasciatus*, *E. rivulatus* and *E. irroratus*. These 4 species share similar distinctive features of their colour patterns: 1) Margin of spinous dorsal fin black or dark red (brown or gold in *E. rivulatus*), 2) dark brown or dark red line along crease at base of dorsal fin, 3) body scales with a white, pale blue or greenish grey spot or centre, and 4) orbit edged with black, red or pale blue. These 4 species also have similar meristic and morphometric features.

E. fasciatus differs from *E. retouti* in having a shorter snout (length contained 4.3 to 5.1 times in head length), fewer lateral-line scales (except for *E. fasciatus* from Oceania, which have high counts like *E. retouti*), the tips of the interspinous dorsal-fin membranes are black (not dark red, except in specimens from Western Australia), the soft dorsal fin and upper caudal-fin rays are not darker than the rest of these fins, and the caudal-fin margin is convex or moderately rounded (except in central Pacific specimens).

In *E. rivulatus* the conspicuous body scale spots are white or pale blue, there is a semicircular red or reddish brown blotch at the base of the pectoral-fin rays and a similar spot anteriorly on isthmus, and the snout is shorter (length contained 4.0 to 5.0 times in head length).

In *E. irroratus*, there are no dark bars on the body, the scale spots are white, and the second dorsal-fin spine is distinctly elongated in adults.

Epinephelus rivulatus (Valenciennes, 1830)

Fig. 399; Pl. XXIIA

SERRAN Epin 52

Serranus rivulatus Valenciennes in Cuv. and Val., 1830:515 (type locality: Réunion).

Synonyms: *Serranus rhyncholepis* Bleeker, 1852c:749 (type locality: Bulucomba, Celebes). *Serranus viridipinnis* De Vis, 1885a:144 (type locality: Moreton Bay, Queensland, Australia). *Epinephelus grammatophorus* Boulenger, 1903:64, pl. 3 (type locality: Natal, South Africa). *Epinephelus raymondi* Ogilby, 1908:93 (type locality: Cape Moreton, Queensland, Australia). *Epinephelus matterni* Fowler, 1918:31, fig. 13 (type locality: Philippine Islands). *Epinephelus homosinensis* Whitley, 1944:267 (type locality: Broome, Western Australia). *Epinephelus spiramen* Whitley, 1945:25 (type locality: 30 miles north of Carnarvon, Western Australia).

FAO Names: **En** - Halfmoon grouper; **Fr** - Mérou demi-lune; **Sp** - Mero medialuna.

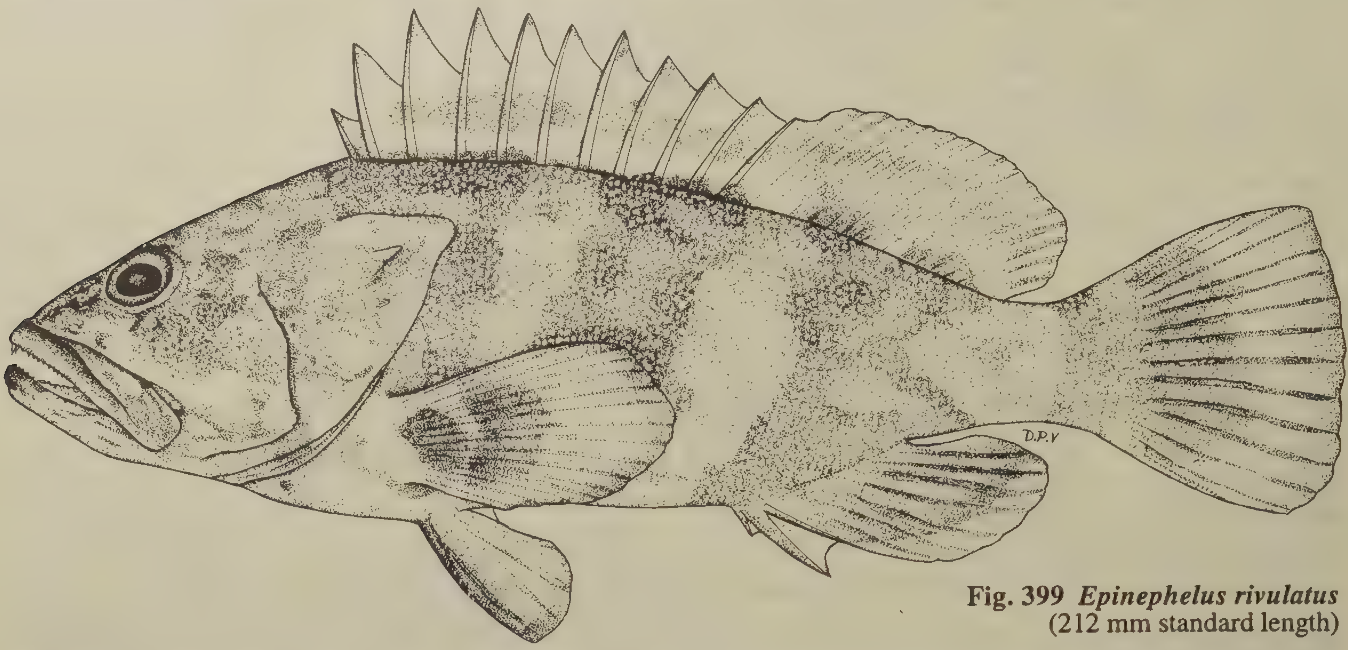


Fig. 399 *Epinephelus rivulatus*
(212 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.2 times in standard length (for fish 12 to 35 mm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat to slightly convex, the dorsal head profile convex; snout length contained 4.0 to 5.0 times in head length; preopercle angular, with enlarged serrae at angle; upper edge of operculum straight, almost horizontal; nostrils subequal; maxilla reaches to or past vertical at rear edge of eye, the ventral edge with a slight step at distal expansion; midlateral part of lower jaw with 2 or 3 rows of teeth. Gill rakers 6 to 8 on upper limb, 14 to 16 on lower limb, 20 to 24 total. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest, its length contained 2.4 to 3.2 times in head length and subequal to the longest dorsal-fin ray; the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral fins fleshy, with 17 to 19 rays; pectoral-fin length contained 1.5 to 1.9 times, pelvic-fin length contained 1.9 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with numerous auxiliary scales; nape and dorsoposterior part of head densely covered with minute auxiliary scales; lateral-line scales 48 to 53; lateral-scale series 86 to 98. Pyloric caeca 26. **Colour**: Body generally reddish to greenish brown, with a small white or pale blue spot (about size of nostrils) on each scale; 4 irregular dark bars usually visible on body and extending onto base of dorsal fin, and a fifth dark bar on peduncle, the third and fourth bars run from soft dorsal fin to anal fin and are usually joined midlaterally; pectoral fins dusky, with a dark red or reddish brown semicircular blotch on base of rays; 2 dark red or reddish brown bands on thorax and a dark brown spot on front of isthmus. Head mostly dark brown or pale reddish, with irregular pale blotches and pale blue or violet vermiculations; 4 white or pale spots along lower part of head (2 on side of lower jaw and upper lip, 1 just behind end of maxilla and last on interopercle); fins greenish yellow or greyish brown, the dorsal usually with a dark brown to black streak along the base (may be restricted to base of spinous part); margin of interspinous dorsal-fin membranes yellow to reddish next to spine, becoming transparent posteriorly, with a pale stripe below triangular part of fin. Some fish with white dots on operculum like those on body.

Geographical Distribution: *E. rivulatus* is widely distributed from the western Indian Ocean to the western Pacific and southward into temperate waters of South Africa, Australia, and New Zealand. We have examined specimens from Yemen, Kenya, Zanzibar, Mozambique, South Africa (south to Knysna), Madagascar, Réunion, Mauritius, Indonesia, Philippines, Taiwan, Japan (Okinawa, Honshu), Australia (Western Australia, Queensland, New South Wales), Lord Howe Island, Norfolk Island, New Zealand (North Island, Bay of Islands), and New Caledonia. Additional records include the Comoro Islands, Viet Nam, Papua New Guinea, and Hong Kong (Fig. 400). Not known from the Red Sea or Persian Gulf.

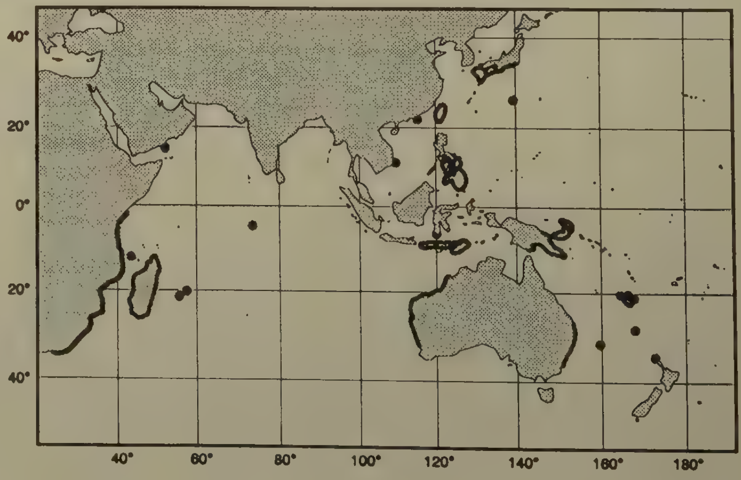


Fig. 400

Habitat and Biology: *E. rivulatus* occurs on rocky bottoms or coral reefs in depths of 10 to 150 m. On the North Kenya Banks, Morgans (1982) found that females were mature at 22 cm standard length (200 g) and the smallest mature male was 25 cm standard length (500 g). Stomach contents comprised small fishes (including *Cyprinocirrhites polyactis* and an eel) and crabs.

Size: Attains at least 37 cm standard length (1.4 kg).

Interest to Fisheries: Probably of some importance in areas where it is common. Caught with handlines, longlines, gillnets, traps, and spear.

Local Names: AUSTRALIA: Chinaman rockcod; HONG KONG: White-dotted grouper, Paak-dim-paan; JAPAN: Shimofurihata; NEW CALEDONIA: Loche brique; REUNION: Cabot sale, Rouge sale.

Literature: Randall and Heemstra (1991).

Remarks: *E. rivulatus* is a member of the *E. fasciatus* species-complex; the other 3 species of this complex are ***E. fasciatus***, ***E. irroratus***, and ***E. retouti***. See the account of ***E. retouti*** for a discussion of this complex. ***E. rivulatus*** is distinguished from the other members of this complex by the dark reddish blotch at the base of the pectoral fins, the dark bands on the thorax, and the margin of the interspinous dorsal-fin membranes is brown or gold (rather than dark red or black).

Epinephelus septemfasciatus (Thunberg, 1793) Fig. 401; Pl. XXIIB SERRAN Epin 91

Perca 7-fasciata Thunberg, 1793a:56, pl. 1, upper fig. (type locality: Japan).

Synonyms: *Plectropoma susuki* Cuvier in Cuv. and Val., 1828:404 (type locality: Japan). *Serranus octocinctus* Temminck and Schlegel, 1842:7, pl. 4, fig. 2 (type locality: Japan).

FAO Names: **En** - Convict grouper; **Fr** - Mérou bagnard; **Sp** - Mero carcelario.

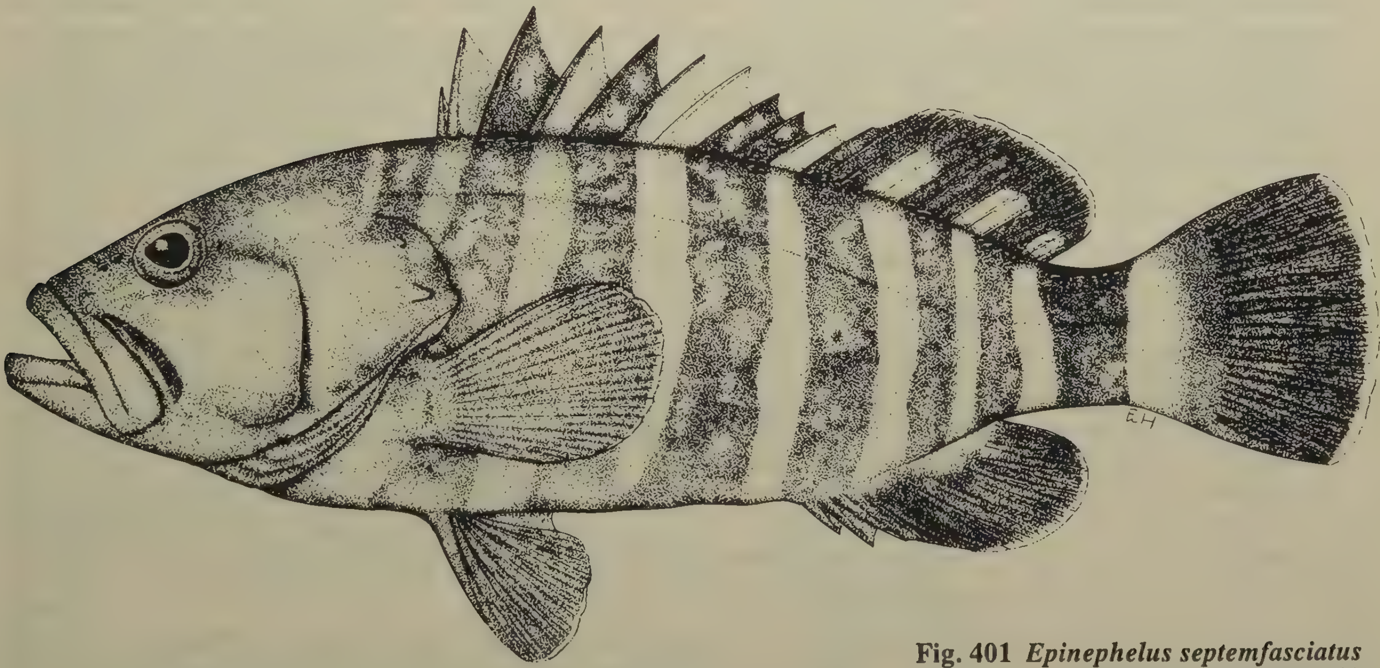


Fig. 401 ***Epinephelus septemfasciatus***
(600 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 3.1 times in standard length (for fish 10 to 47 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital distinctly convex, the dorsal head profile also convex; diameter of rear nostrils of adults 3 or 4 times that of anterior nostrils and greater than distance from rear nostril to edge of orbit; preopercle angular, the serrae at angle enlarged; lower edge of preopercle with 1 or 2 small spines anterior to angle; lower edge of subopercle and rear edge of interopercle serrate or smooth; upper edge of operculum convex; maxilla reaches to below rear half of eye; no distinct step on lower edge of maxilla; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 9 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and 14 or 15 rays, the interspinous membranes deeply incised, the third or fourth spine longest, its length contained 2.1 to 2.7 times in head length and subequal to longest dorsal-fin rays; anal fin with III spines and 9 rays; pectoral-fin rays 17 to 19; pelvic fins shorter than pectoral fins, pelvic-fin length contained 1.8 to 2.0 times in head length; caudal-peduncle depth contained 1.2 to 1.5 times in its length; caudal fin rounded. Lateral-body scales ctenoid, with a few auxiliaries; lateral-line scales 63 to 70;

lateral-scale series 105 to 118. Pyloric caeca numerous, in 3 or 4 dendritic bundles with more than 80 terminal branches. **Colour**: Body buff with 7 or 8 dark bars, first on nape, often merging with dark colour of head, second dark bar below third and fourth dorsal-fin spines, sixth and seventh dark bars narrower than other bars and closer together, extending from middle rays of soft dorsal fin to anal-fin base; 3 pale interspaces below soft dorsal fin; last dark bar covers most of caudal peduncle and extends to base of last 2 or 3 dorsal-fin rays; pelvic fins blackish brown; median fins blackish brown distally with narrow pale margin; dark maxillary streak usually hidden by maxilla. Gill rakers and gill arches pale, without minute melanophores.

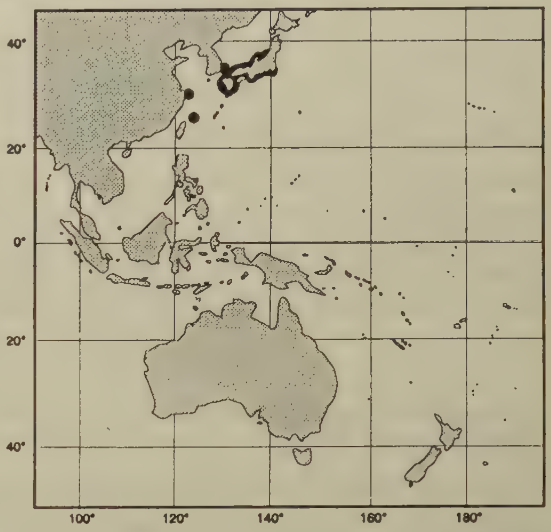


Fig. 402

Geographical Distribution: *E. septemfasciatus* is known with certainty only from Japan, Korea, and China (Fig. 402); reports of this species from other areas appear to be based on misidentifications of *E. octofasciatus*.

Habitat and Biology: Rocky reefs in shallow water; common in depths of 5 to 30 m. Kitajima et al. (1991) described the development of eggs, larvae and juveniles reared from artificially fertilized eggs. The newly hatched larvae (1.85 mm) have an oil globule at the posterior end of the yolk. The yolk was mostly absorbed and melanophores were visible on the dorsal surface of the abdominal cavity and midventrally at the middle of the tail by the third day after hatching (total length 2.6 mm). Rudiments of the second dorsal- and pelvic-fin spines appeared at 13 days (3.45 mm total length). At 23 days (4.25 mm total length) 2 spines appeared on the preopercle and the dorsal surface of the abdominal cavity was covered with melanophores. In the 25-day larva (4.8 mm total length), the second dorsal- and pelvic-fin spines are elongated and serrate, and the notochord is still straight. In a postlarva of 28 days (6.8 mm total length), the notochord was flexed, the second dorsal- and pelvic-fin spines were greatly elongated, rudiments of the median fin rays were visible, and the largest spine on the preopercle was about equal to the diameter of the eye. At 33 days (8.1 mm total length), the second dorsal- and pelvic-fin spines were fully elongated (90% and 65% of standard length respectively), thereafter they decreased with growth. In the 38-day (10.5 mm total length) postlarva, all of the fin rays are differentiated. At 60 days (30 mm total length) pigmentation developed rapidly all over the body, the second dorsal- and pelvic-fin spines had decreased to adult proportions, and the juveniles descended to the bottom of the rearing tank.

Size: According to Katayama (1988) *E. septemfasciatus* attains 90 cm standard length.

Interest to Fisheries: This species is of some commercial importance in Japan and probably also in Korea and China.

Local Names: JAPAN: Mahata.

Literature: Randall and Heemstra (1991).

Remarks: *E. septemfasciatus* is very similar to *E. octofasciatus*; both species are known from Japan, but *E. septemfasciatus* appears to be more common in shallow water. *E. octofasciatus* differs in having a deeper body (depth contained 2.2 to 2.7 times in standard length), deeper peduncle (peduncle depth contained 0.9 to 1.3 times in its length), pelvic fins subequal to or longer than pectoral fins, the diameter of the rear nostrils is not greater than distance from nostril to orbit, and in the configuration of the dark bars on body (only 5 bars wholly below dorsal fin, the last one broader than others and extending from middle 5 to 7 dorsal-fin rays to rear half of anal fin; 2 pale interspaces below soft dorsal fin).

E. mystacinus (of the western Atlantic and Galapagos) has the dark body bars narrower than the pale interspaces, and the broad dark bar covering the peduncle does not extend over the bases of the last 2 or 3 dorsal-fin rays.

E. ergastularius, which is known only from the east coast of Australia, is another similar species. Adults have a truncate or emarginate caudal fin and fine dermal ridges on the body at the base of the dorsal fin; also, the fins have white margins. Juveniles can be distinguished by the spacing of the dark brown bars on the body: on *E. ergastularius* the pale space separating the second and third dark bars and that between the fourth and fifth bars are distinctly narrower than the interspaces between the third and fourth or fifth and sixth bars; on *E. septemfasciatus* all the pale interspaces are about the same width, except for the one between the fifth and sixth dark bars, which is distinctly narrower than the others.

Katayama (1975) stated that *E. septemfasciatus* has only 7 or 8 pyloric caeca, but the two specimens (20 and 47 cm standard length) that we dissected both had about 80 caeca in 3 or 4 multifurcate bundles.

Epinephelus sexfasciatus (Valenciennes, 1828)

Fig. 403; Pl. XXIIC

SERRAN Epin 92

Serranus sexfasciatus Valenciennes in Cuv. and Val., 1828:360 (type locality: Java).

Synonyms: None.

FAO Names: **En** - Sixbar grouper; **Fr** - Mérou six raies; **Sp** - Mero de seis bandas.

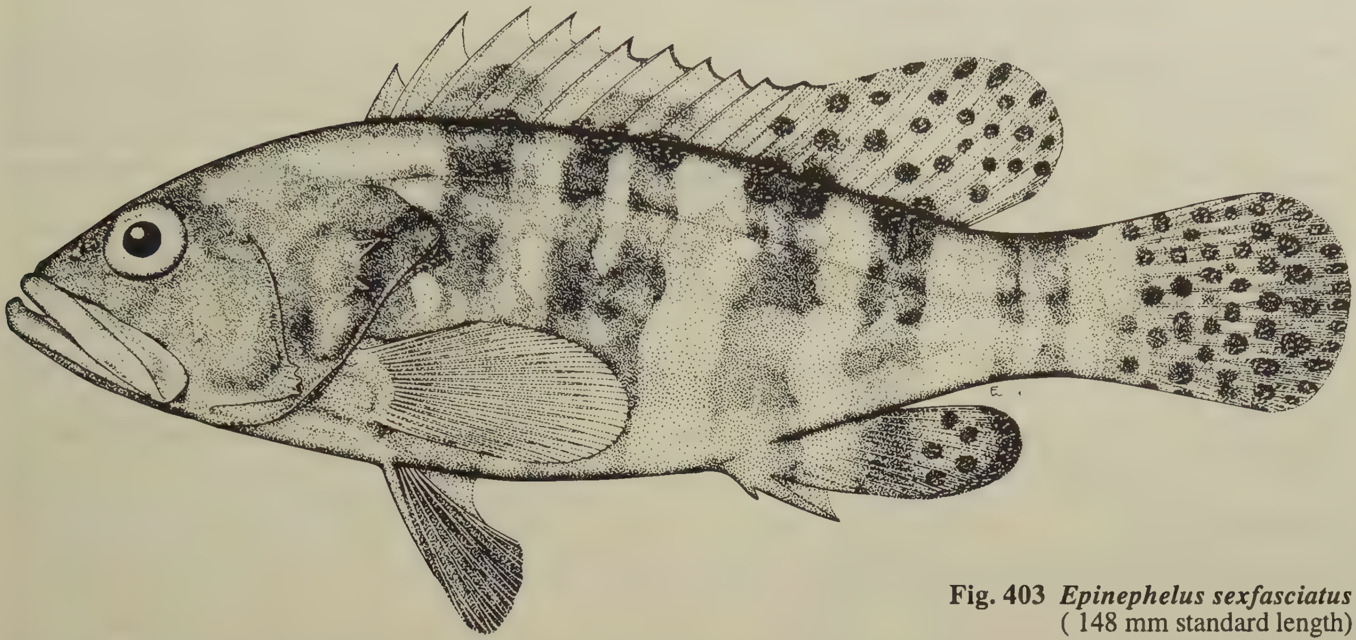


Fig. 403 *Epinephelus sexfasciatus* (148 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.2 times in standard length (for fish 9 to 21 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat or slightly convex, the dorsal head profile convex; preopercle with 2 to 4 greatly enlarged serrae at the angle; upper edge of operculum straight; nostrils subequal; maxilla reaches to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of subequal teeth. Gill rakers 7 or 8 on upper limb, 13 to 15 on lower limb, 20 to 23 total; longest gill raker shorter than longest gill filaments. Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, its length contained 2.3 to 2.7 times in head length and about equal in length to longest dorsal-fin ray, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral fins not fleshy, with 17 to 19 rays; pectoral-fin length contained 1.5 to 1.7 times, pelvic-fin length contained 1.8 to 2.2 times in head length; caudal fin rounded; caudal-peduncle depth contained 2.6 to 3.4 times in head length. Lateral-body scales ctenoid, with a few auxiliary scales; lateral-line scales 46 to 51; lateral-scale series 82 to 96. Pyloric caeca 7 or 8. **Colour**: Head and body pale greyish brown; 5 dark brown bars on body and 1 on nape (dark bars usually more or less divided vertically by a narrow pale bar); scattered pale spots may be present on body, and some faint small brown spots are often visible on the edges of the dark bars; soft dorsal, caudal, and pelvic fins dusky grey, the pectoral fins greyish or dusky orange-red; jaws and ventral parts of head sometimes pale reddish brown.

Geographical Distribution: *E. sexfasciatus* is known only from the tropical western Pacific Ocean: Indonesia (Sumatra, Java, Bali, Lombok, Celebes, Moluccas), Singapore, Malaysia, Thailand, Viet Nam, Philippines, Papua New Guinea, Louisiade Archipelago, and Australia (north coast from Western Australia to Queensland) (Fig. 404).

Habitat and Biology: *E. sexfasciatus* is usually found on silty sand or muddy bottoms at depths of 10 to 80 m. This preference for soft-bottom habitats may account for its restricted distribution and absence at oceanic islands. Females are mature at 13 cm standard length. Feeds on small fishes and crustaceans.

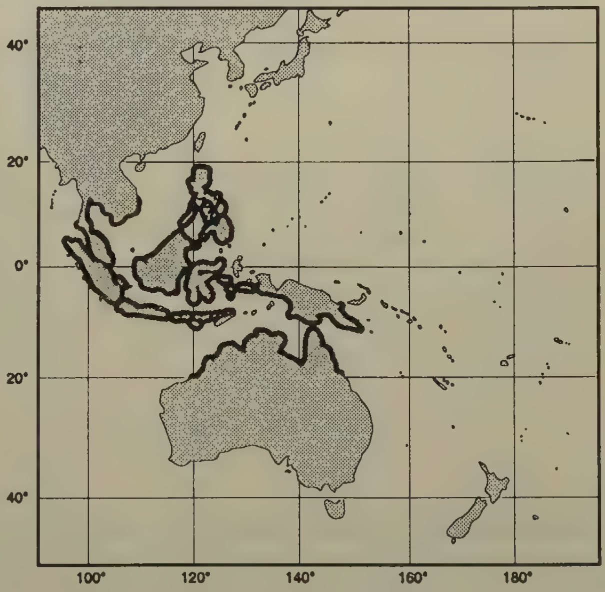


Fig. 404

Size: According to Schroeder (1980), *E. sexfasciatus* attains 30 cm standard length, but the largest specimen that we have seen is only 21 cm standard length.

Interest to Fisheries: Although *E. sexfasciatus* is a small species, it is common and readily caught in trawls; consequently it is often seen in local markets.

Local Names: JAPAN: Kokuten-hirehata; MALAYSIA: Kerapo-bebeh (Malay); Balang (Sundan); PHILIPPINES: Gaot (Visayan); SINGAPORE: Lu gu hou.

Literature: Randall and Heemstra (1991).

Remarks: *E. sexfasciatus* is closely related to ***E. diacanthus***, which also has 5 dark bars on the body, greatly enlarged serrae at the angle of the preopercle, and similar morphological features. ***E. diacanthus***, the northern Indian Ocean sister species of ***E. sexfasciatus***, also prefers mud and silty sand habitats. It differs from *E. sexfasciatus* in having no spots on the median fins, more scales (lateral-line 52 to 60; lateral-scale series 103 to 121), a larger head (length contained 2.2 to 2.4 times in standard length), and a narrower caudal peduncle (peduncle depth contained 3.7 to 4.7 times in head length).

Epinephelus socialis (Günther, 1873) Fig. 405; Pl. XXIID SERRAN Epin 93

Serranus socialis Günther, 1873:7, pl. 8, fig. B (type locality: Tahiti, Society Islands; lectotype BMNH 1873:4.3.1, designated by Randall, 1964).

Synonyms: None.

FAO Names: **En** - Surge grouper; **Fr** - Mérou houleux; **Sp** - Mero oleado.

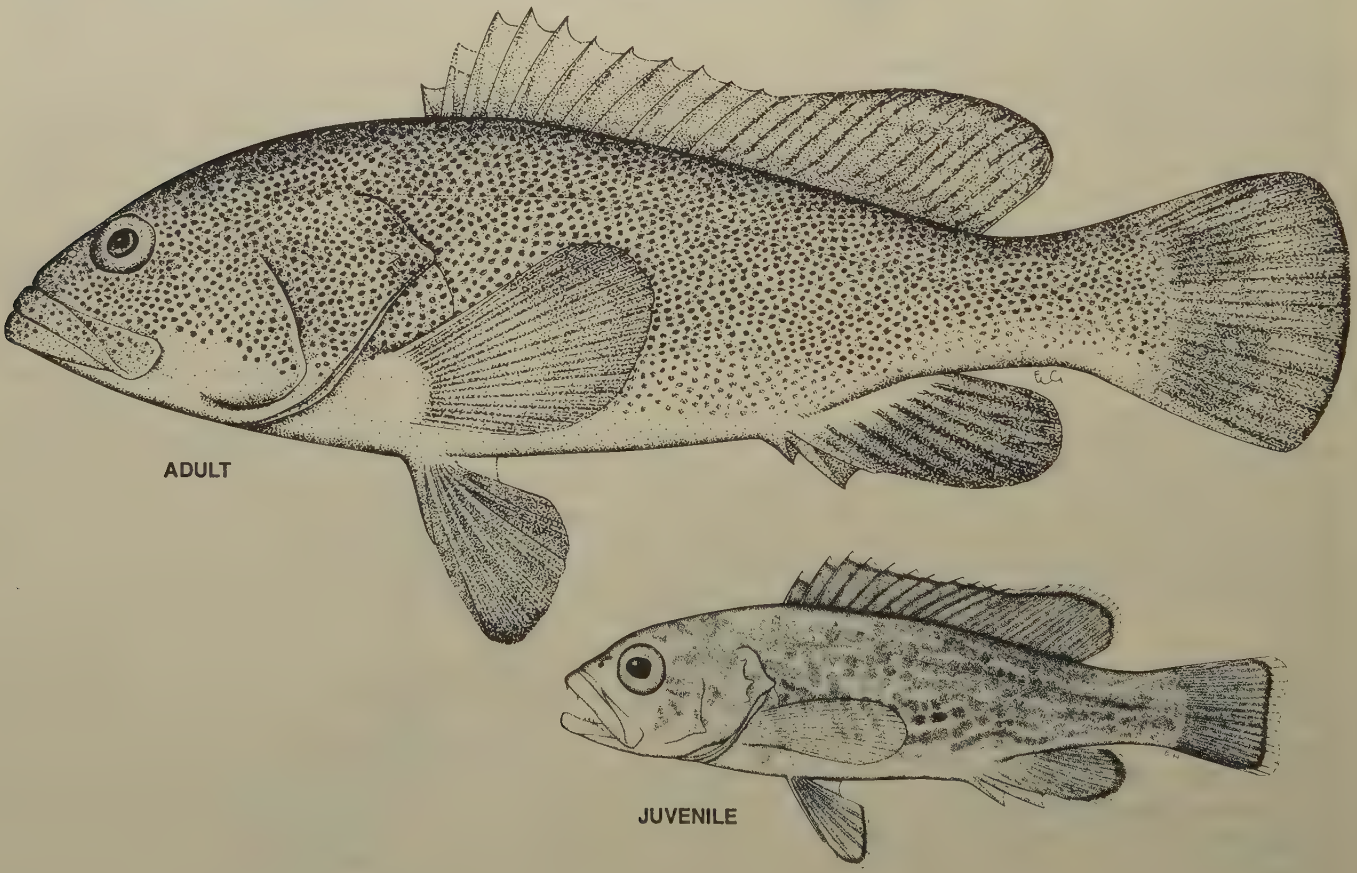


Fig. 405 ***Epinephelus socialis***
(adult 339 mm standard length, juvenile 34 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.4 times in standard length (for fish 10 to 34 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area flat or slightly convex, the dorsal head profile convex; preopercle rounded, finely serrate; upper edge of operculum sinuous; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 3 or 4 rows of teeth. Gill rakers 8 to 10 on upper limb, 16 to 20 on lower limb, total 25 to 28. Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, its length contained 2.6 to 3.6 times in head length, the interspinous membranes moderately incised; anal fin with III spines and 8 rays; pectoral fins fleshy, with 18 or 19 rays; pectoral-fin length contained 1.6 to 1.9 times and pelvic-fin length contained 1.8 to 2.2 times in head length; caudal fin rounded. Lateral-body scales of juveniles (less than 20 cm standard length) ctenoid; lateral-body scales of subadults (20 to 30 cm standard length) weakly ctenoid, with auxiliary scales; in adults (greater than 30 cm standard length) the body scales are smooth (mostly embedded) with numerous auxiliary scales; lateral-line scales 64 to 70; lateral-scale series 97 to 111. Pyloric caeca about 20. **Colour**: Head and body whitish, covered (except ventral part of head, chest and abdomen) with small close-set blackish brown spots, those on rear part of body often coalesced to form irregular longitudinal bands; the dark spots become relatively smaller with growth, and on a fish of 21 cm they are black dots about the size of the rear nostrils; 4 large blackish blotches usually visible on body at base of dorsal fin and a fifth black saddle blotch on peduncle. Median fins coloured like body basally, becoming dark greyish brown distally, the soft dorsal, caudal and anal fins with small white spots, the margin of these fins white, usually with a black submarginal band; pectoral fins dark greyish brown with a white margin posteriorly and small whitish spots; pelvic fins dark greyish brown, with a white leading edge.

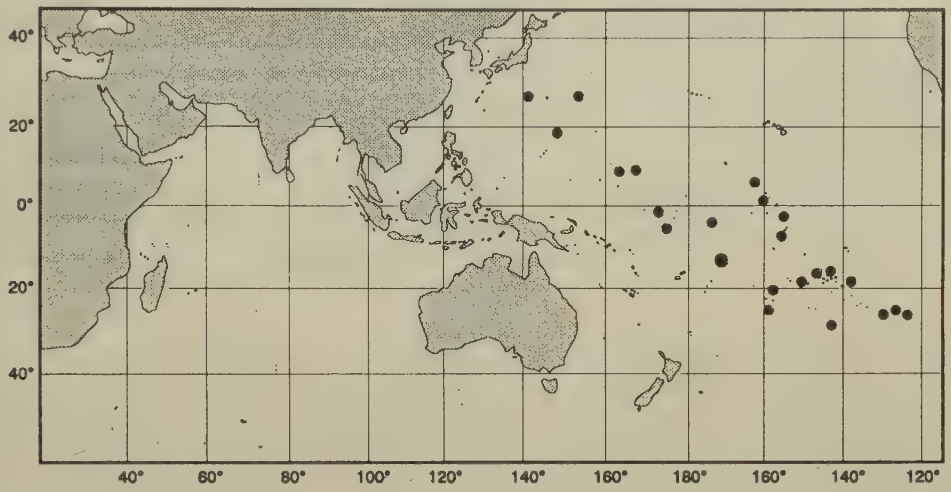


Fig. 406

Geographical Distribution: *E. socialis* is known only from the islands of Oceania: Marcus Island, Marshall Islands, Phoenix Islands, American Samoa, Cook Islands, Line Islands, Society Islands, Rapa, Tuamotus, and the Pitcairn Group (Fig. 406). It is widely distributed over the Pacific Plate, but it is not known at Hawaii, the Marquesas, the Caroline Islands, or at any of the Melanesian islands. *E. socialis* has been found at two localities off the Pacific Plate: Ogasawara (Bonin) Islands (Zama and Fujita, 1977:108, pl. 6, fig. A [as "*Epinephelus* sp."]) and Mariana Islands (Myers, 1989:106, pl. 32, fig. D).

Habitat and Biology: *E. socialis* is a shallow-water species of coral reefs; it is more common on atolls than high islands, and is usually found in outer reef areas exposed to heavy surge. Juveniles and occasionally adults are collected from tidepools. It feeds on crustaceans, (mainly grapsid crabs), octopuses, and fishes.

Size: Attains at least 42 cm standard length (52 cm total length).

Interest to Fisheries: *E. socialis* is of some importance at islands where they are abundant (e.g. the Tuamotus). Caught with spears and handlines.

Local Names: GAMBIER ISLANDS: Hapuku; SOCIETY ISLANDS: Atara; TUAMOTU ISLANDS: Apia, Garea.

Literature: Bagnis et al. (1972); Randall and Heemstra (1991).

Remarks: Adults of *E. socialis* and *E. ongus* are superficially similar. Although *E. ongus* is basically dark with white spots and *E. socialis* whitish with dark spots, their colour patterns become similar in adults when the spots merge to form narrow undulating dark and light longitudinal bands; also, both have dark median fins with white spots and margins and blackish submarginal bands. Randall (1980a:fig. 19) illustrated a specimen of *E. ongus* as *E. socialis*. *E. ongus* differs in having a distinct black maxillary streak, white spots on spinous part of the dorsal fin, the upper edge of the operculum distinctly convex, 15 to 17 pectoral-fin rays, and 48 to 53 lateral-line scales.

Epinephelus spilotoceps Schultz, 1953 Fig. 407; Pl. XXIIE **SERRAN Epin 54**

Epinephelus spilotoceps Schultz, 1953:332, 357, figs 56 and 57 (type locality: Bikini Atoll, Marshall Islands).

Synonyms: *Epinephelus salonotus* Smith and Smith, 1963:15, pl. 14, fig. I (type locality: Cape Delgado, Mozambique).

FAO Names: **En** - Foursaddle grouper; **Fr** - Mérou quatre selles; **Sp** - Mero cuatro monturas.

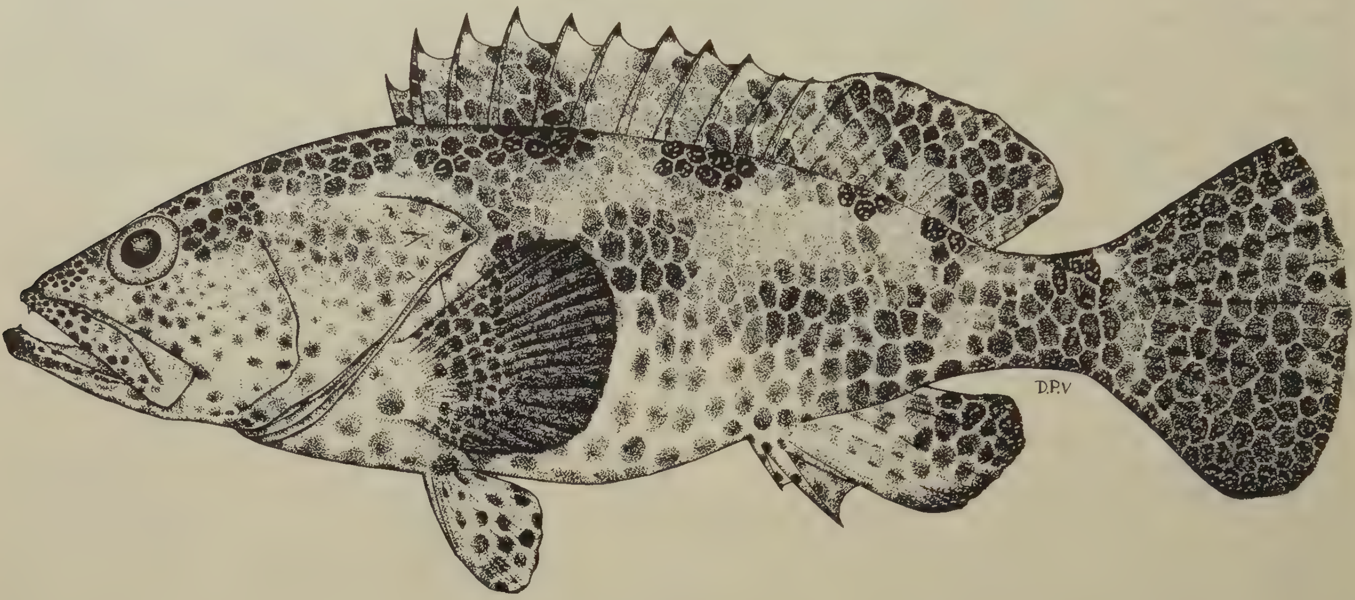


Fig. 407 *Epinephelus spilotoceps* (300 mm standard length)

Diagnostic Features: Body depth contained 3.1 to 3.6 times in standard length (for fish 10 to 25 cm standard length). Head length contained 2.2 to 2.6 times in standard length; interorbital area flat or concave; dorsal head profile convex; preopercle rounded, with a shallow notch, below which the serrae are enlarged but covered with skin; upper edge of operculum almost straight; nostrils subequal; maxilla reaches to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth; lower jaw projecting in front of upper jaw. Gill rakers 6 to 9 on upper limb, 16 to 18 on lower limb. Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, its length 2.8 to 3.6 times in head length and distinctly shorter than longest dorsal-fin ray; anal fin with III spines and 8 rays, the second spine usually longest, its length contained 2.4 to 3.7 times in head length and usually more than peduncle depth; pectoral-fin rays 17 to 19; pectoral-fin length 21 to 24% of standard length, contained 1.7 to 2.1 times in head length; pelvic-fin length contained 1.9 to 2.4 times in head length; caudal-peduncle depth contained 3.5 to 4.1 times in head length; caudal fin rounded; middle caudal-fin rays contained 1.7 to 2.0 times in head length. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 59 to 69; lateral-scale series 86 to 100. **Colour**: Head, body, and median fins pale, mostly covered with close-set dark brown, olive, or reddish brown spots, those on dorsolateral parts of head and body and on median fins polygonal and close-set, the pale interspaces forming a white reticulum; spots on ventral part of head and body more rounded, more separated and often more reddish; large dark brown to black saddle blotch on body at base of last 4 dorsal-fin spines and extending onto basal part of fin; 2 similar but smaller dark blotches at base of soft dorsal-fin rays and a third on rear end of peduncle; these dark saddle blotches uniformly pigmented (on juveniles) or comprising a group of extra dark body spots separated by the white reticulum (on adults); spots on head progressively smaller and darker anteriorly, those on snout blackish brown and about size of nostrils, with 3 or 4 irregular rows along front of upper lip; pectoral fins with close-set reddish brown spots, larger and more distinct towards base of pectoral fins, the distal part dull yellowish green; tips of dorsal-fin spines blackish, with a short white filament.

Geographical Distribution: *E. spilotoceps* is widely distributed in the tropical Indo-Pacific region, from the east coast of Africa (from Zanzibar south to Ponta Zavora, Mozambique) to the Line Islands in the central Pacific (Fig. 408). Except for its occurrence along the African coast, it seems to be primarily an insular species; we examined one specimen from Hong Kong, but there are no other records from the Asian mainland. It is not known from the Red Sea, Persian Gulf, Sri Lanka, Philippines, Taiwan, Japan, or Australian waters (although it is found at Rowley Shoals off Western Australia). It occurs at most (probably all) of the islands of the tropical Indian and west-central Pacific oceans.

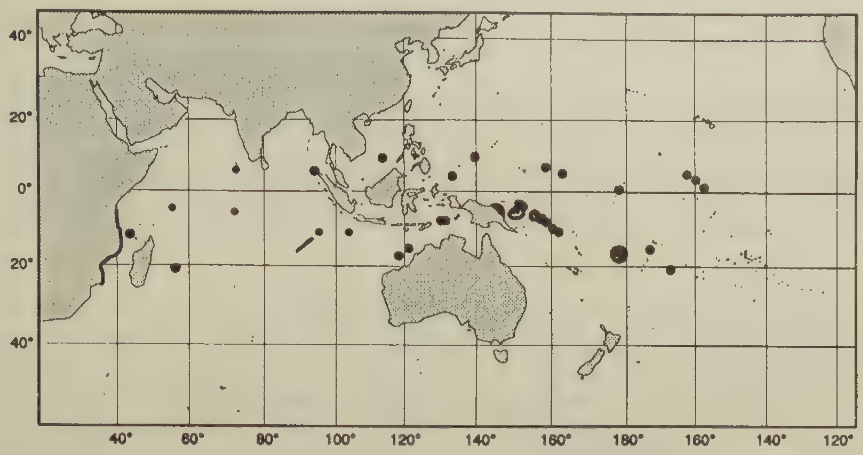


Fig. 408

Habitat and Biology: Like the other “reticulated groupers,” *E. spilotoceps* is a shallow-water coral-reef species. Nothing has been published on the biology of this species.

Size: Maximum known, 25 cm standard length (31 cm total length).

Interest to Fisheries: *E. spilotoceps* is probably of importance to artisanal fisheries where it is common, but there are no statistics available for this species.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: *E. spilotoceps* is one of 9 shallow-water coral-reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These “reticulated groupers” have been much confused in the literature, and many museum specimens have been misidentified. The other species differ from *E. spilotoceps* as follows:

E. bilobatus has 3 bilobed dark brown blotches or close-set pairs of dark spots on body at base of dorsal fin but no dark saddle on peduncle, dorsal-fin rays 17 or 18, and lateral-line scales 48 to 52.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), dorsal-fin rays 16 to 18, 2 oblique dark bands on sides of chest, 2 rows of teeth at sides of lower jaw, and lateral-line scales 48 to 52.

E. hexagonatus has conspicuous white dots on body between the dark spots (white dots not apparent on some preserved specimens) and a large, irregular, dark brown or olive spot behind eye; second anal-fin spine distinctly longer than third, length of second anal-fin spine contained 2.1 to 2.5 times in head length; length of fifth dorsal-fin spine contained 2.5 to 2.8 times in head length; and pelvic-fin length contained 1.8 to 2.1 times in head length.

E. macrospilos has the lateral-body scales mostly smooth, pectoral fins dusky with narrow white edge, no large black blotch at base of last 4 dorsal-fin spines (although 2 or 3 adjacent spots here may be darker than other brown spots on body), dark spots on snout much larger than nostrils, and lateral-line scales 48 to 52.

E. maculatus has the third or fourth dorsal-fin spine longest, its length contained 2.1 to 2.6 times in head length and usually longer than dorsal-fin rays, the interspinous dorsal-fin membranes not or only slightly incised; and small juveniles are yellowish brown, with well separated small black spots (mainly on head and fins) and a few irregular white spots and blotches on body and dorsal fin.

E. melanostigma has a single black blotch at base of last 4 dorsal-fin spines, dark spots on snout distinctly larger than nostrils, and caudal-peduncle depth contained 3.2 to 3.8 times in head length and usually more than length of second anal-fin spine.

E. merra has pectoral fins covered with conspicuous, small black spots largely confined to the rays, no dark saddle blotches at base of dorsal fin, and lateral-line scales 48 to 54.

E. quoyanus has no black blotches at base of dorsal fin (although some brown body spots may be darker here), sides of chest with 2 oblique dark brown bands, dorsal-fin rays 16 to 18, body depth contained 2.8 to 3.2 times in standard length, caudal-peduncle depth contained 3.1 to 3.6 times in head length, and pectoral-fin length contained 1.2 to 1.7 times in head length.

Epinephelus stictus Randall and Allen, 1987

Fig. 409; Pl. XXIIF

SERRAN Epin 94

Epinephelus stictus Randall and Allen, 1987:394, fig. 1 (type locality: 20 km south of Heywood Shoals, Western Australia; 13°33'S, 124°2'E; depth 138 to 142 m).

Synonyms: Often misidentified as "*Epinephelus diacanthus*."

FAO Names: **En** - Black-dotted grouper; **Fr** - Mérou points noirs; **Sp** - Mero punteado negro.

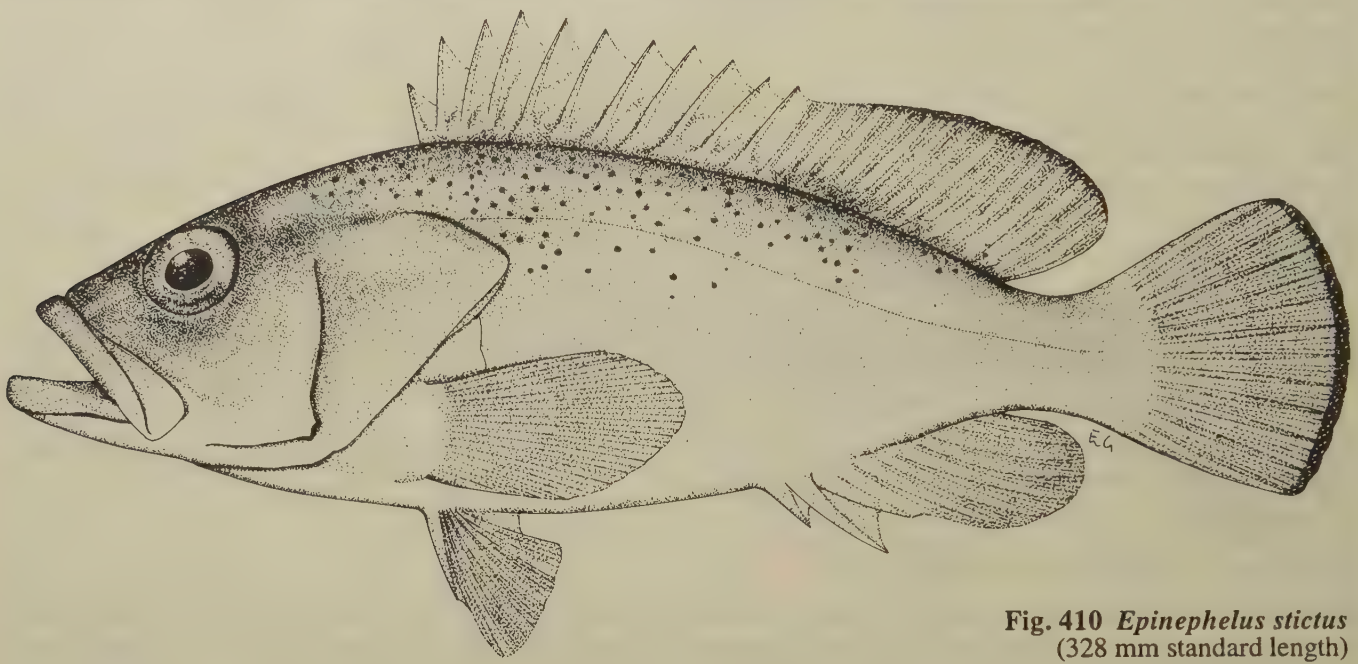


Fig. 410 *Epinephelus stictus* (328 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.4 times in standard length (for fish 12 to 33 cm standard length). Head large, its length contained 2.2 to 2.4 times in standard length; interorbital region flat, the dorsal head profile slightly convex; preopercle with 1 to 4 distinctly enlarged serrae at the angle; upper edge of operculum straight; nostrils subequal; maxilla reaches to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 or 8 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 15 or 16 rays, the third or fourth spine longest, its length contained 2.7 to 3.4 times in head length and shorter than longest rays, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral fins not fleshy, with 18 to 20 rays; pectoral-fin length contained 1.7 to 1.9 times and pelvic-fin length contained 2.1 to 2.6 times in head length; caudal fin rounded; caudal-peduncle depth contained 3.8 to 4.2 times in head length. Lateral-body scales ctenoid, without auxiliary scales; lateral-line scales 48 to 51; lateral-scale series 84 to 96. Pyloric caeca 12. **Colour**: Body and head yellowish brown dorsally; belly and rear part of body whitish ventrally; chest and ventral parts of head pale reddish orange; body with 5 faint oblique dark bars (may be lost in preservative); midlateral part of each bar may be darker, representing a series of squarish dark blotches continued from the dark band running from eye to end of operculum; numerous dark brown to black dots on dorsolateral parts of head and body, sometimes concentrated within dark bars and bands. Fins pale, the rays darker than membranes; soft dorsal and caudal fins with narrow dark brown margin; pelvic and anal fins often darker than other fins; anal fin may also have a narrow dark margin; dark line at base of dorsal fin (indistinct anteriorly).

Geographical Distribution: *E. stictus* is known only from southern Japan, Hong Kong, Hainan Island, Viet Nam, "South China Sea", Java, and northwest Australia (Fig. 410). The Japanese records (Katayama, 1960, 1988, as "*Epinephelus diacanthus*") may be based on the single specimen reported from Kochi City by Kamohara (1954). The record from Taiwan (Katayama, 1960:168 "Formosa") is dubious, as neither Shen (1984) nor Lee (1990) report this species in their surveys of Taiwanese serranids.

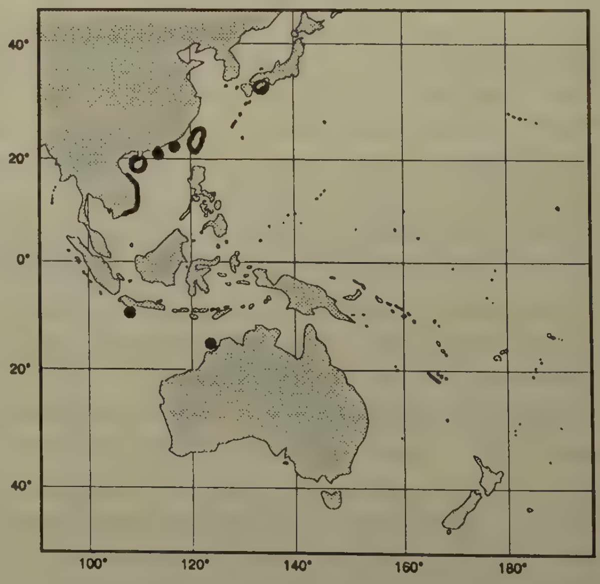


Fig. 409

Habitat and Biology: *E. stictus* is found on mud or sand bottom in depths of 60 to 142 m.

Size: Attains at least 33 cm standard length (41 cm total length).

Interest to Fisheries: Although this species was one of the most common species of grouper caught by trawlers in the vicinity of Hong Kong, Chan (1968) reported that it was not of much commercial importance. The small size and poor edible quality of this species probably accounts for its low value in the markets.

Local Names: HONG KONG: Six-banded grouper, Cheung-pei-paan; JAPAN: Aohata-modoki.

Literature: Randall and Heemstra (1991).

Remarks: *E. stictus* is most similar to ***E. diacanthus*** of the northern Indian Ocean. These two species have a large head, similar shaped body, distinctly enlarged serrae at the angle of the preopercle, the same fin-ray counts, a colour pattern of 5 dark bars on body, and both species are found on sedimentary bottoms. ***E. diacanthus*** differs from *E. stictus* in lacking black dots on the body and in having 52 to 60 lateral-line scales, lateral-scale series 103 to 21, and more gill rakers (8 to 10 on upper limb, 15 to 17 on lower limb).

Epinephelus stoliczkae (Day, 1875)

Fig. 411; Pl. XXIIIA

SERRAN Epin 55

Serranus stoliczkae Day, 1875:11, pl. 1, fig. 3 (type locality: coast of Sind, Pakistan).

Synonyms: None.

FAO Names: **En** - Epaulet grouper; **Fr** - Mérou épaulette; **Sp** - Mero hombrero

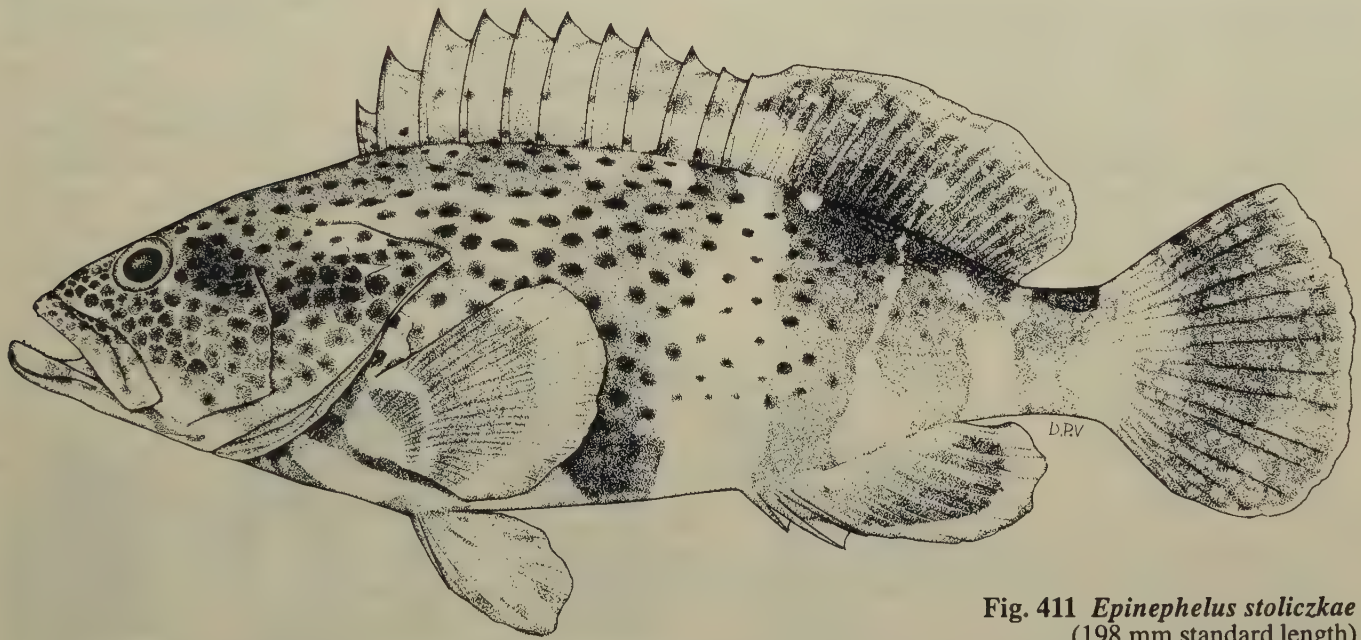


Fig. 411 ***Epinephelus stoliczkae***
(198 mm standard length)

Diagnostic Features: Body robust, the depth contained 2.8 to 3.3 times in standard length (for fish 10 to 26 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital slightly to moderately convex; serrae at corner of preopercle moderately enlarged; upper edge of operculum almost straight; nostrils subequal or posterior nostrils slightly larger; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 6 to 8 on upper limb, 13 to 15 on lower limb, total 20 to 23. Dorsal fin with XI spines and 16 to 18 rays, the fourth spine usually longest, its length contained 2.4 to 3.1 times in head length and subequal to longest ray, the interspinous membranes incised; anal fin with III spines and 8 rays, the second and third spines subequal; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.0 times, pelvic-fin length contained 2.0 to 2.5 times in head length; caudal fin rounded. Body scales smooth except for area covered by pectoral fin; lateral-line scales 48 to 53; lateral-scale series 93 to 106. **Colour:** Head and body yellowish grey, with dark orange-red or reddish brown spots except ventrally and posteriorly; a dark grey bar below posterior dorsal-fin spines, 2 more dark bars below soft dorsal fin and another on caudal peduncle (forming a black saddle dorsally); pectoral-fin base pale, with a dark oval or semicircular blotch across base, central part of fin dark brownish grey, distal third of fin yellowish; chest pale, with dark bands; spinous dorsal fin yellowish, with a row of dark red spots along the base and 2 faint dark longitudinal bands; other fins dark yellowish grey-brown; median fins with a broad yellowish margin posteriorly.

Geographical Distribution: *E. stoliczkae* is known from the Red Sea (including Gulf of Suez) and northwestern Indian Ocean to the coast of Pakistan. We have examined specimens from the Red Sea, Gulf of Aden, Somalia, Gulf of Oman, and Pakistan (Fig. 412). It has not been reported from the Gulf of Aqaba or the Persian Gulf.

Habitat and Biology: This species occurs on shallow sandy bottoms near small coral heads; it is not known from well-developed coral reefs. Nothing has been published on the biology of this species.

Size: *E. stoliczkae* attains at least 38 cm total length.

Interest to Fisheries: No published information is available for this species. Caught with hook-and-line and in traps. Sold fresh in local markets.

Local Names:

Literature: Randall and Heemstra (1991).

Remarks: The distinctive colour pattern of *E. stoliczkae* is unlikely to be confused with other species. Although *E. rivulatus* is vaguely similar, it lacks dark reddish brown spots on the head and body, and each body scale has a small bluish white spot.

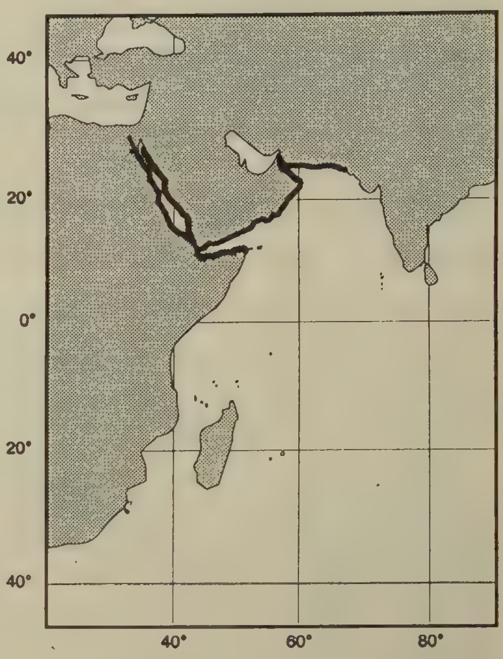


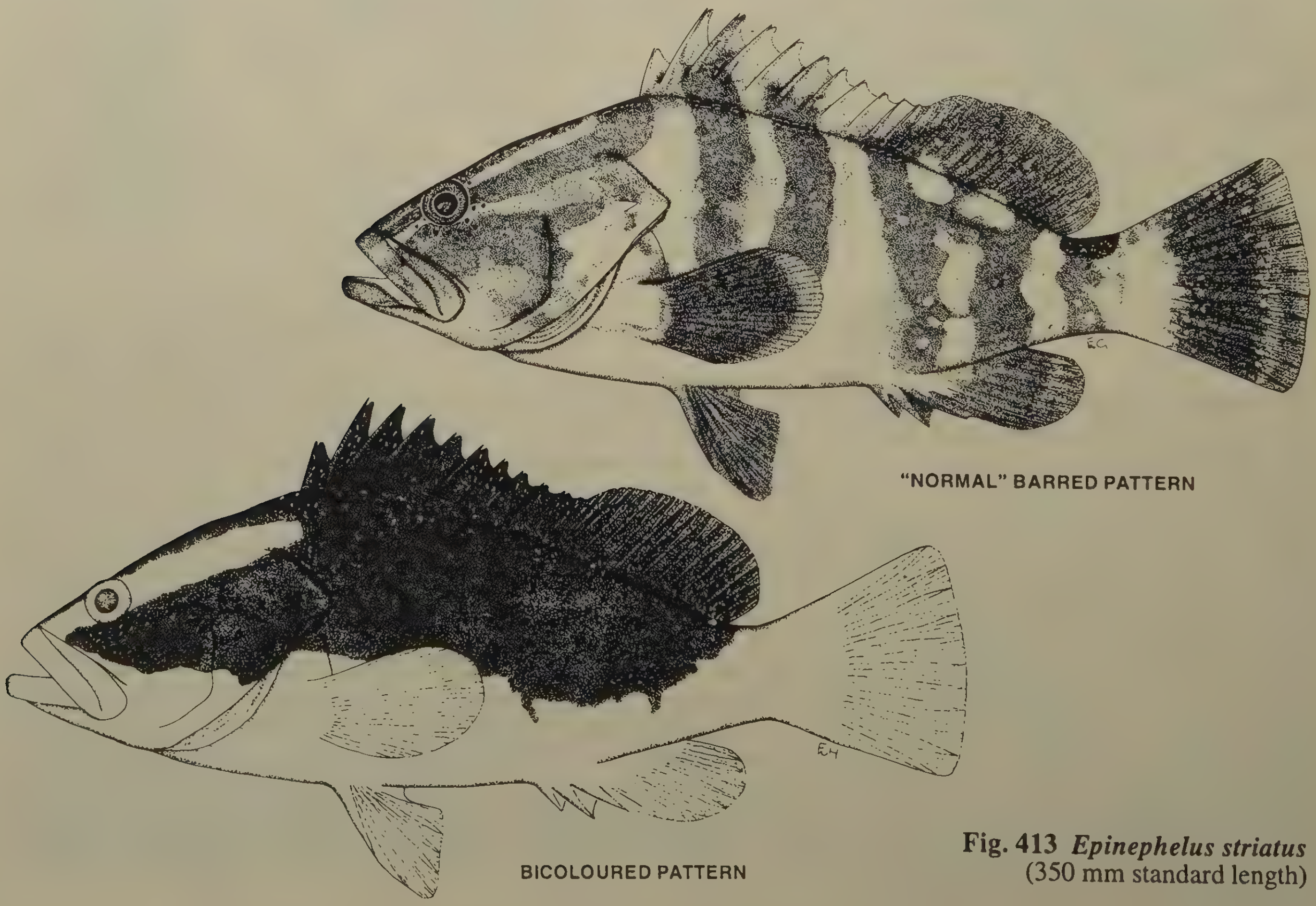
Fig. 412

Epinephelus striatus (Bloch, 1792) Fig. 413; Pl. XXIIIB SERRAN Epin 22

Anthias striatus Bloch, 1792:6:125, pl. 324 (type locality: Atlantic Ocean).

Synonyms: *Anthias cherna* Bloch and Schneider, 1801:310 (after Parra, 1787:pl. 24, fig. 1; type locality: Cuba). *Sparus chrysomelas* Lacepéde, 1802:160 (based on a drawing by Plumier; type locality: Martinique). *Serranus gymnopareius* Valenciennes in Cuv. and Val., 1828:248 (locality unknown).

FAO Names: **En** - Nassau grouper; **Fr** - Mérou rayé; **Sp** - Cherna criolla.



"NORMAL" BARRED PATTERN

BICOLOURED PATTERN

Fig. 413 *Epinephelus striatus* (350 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 2.9 times in standard length (for fish 16 to 33 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital convex; preopercle evenly serrate, without salient angle; posterior nostrils somewhat enlarged and elongated or comma-shaped in large adults. Gill rakers 8 or 9 on upper limb and 15 to 17 on lower limb, total 23 to 26. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest and the interspinous membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19; caudal fin rounded in juveniles, convex in adults. Scales ctenoid, about 50 lateral-line scales and 98 to 108 lateral-scale series. **Colour**: Ground colour generally buff, with 5 dark brown vertical bars and a large black saddle blotch on top of caudal peduncle; a row of black dots below and behind eye. Distinctive dark tuning fork mark beginning at front of upper jaw, extending dorsally along interorbital region, and bifurcating on top of head behind the eyes; another dark band from tip of snout through eye and then curving upward to meet its fellow just before dorsal-fin origin. Some fish have irregular pale spots and blotches all over the head and body; specimens from deep water are somewhat pinkish or reddish ventrally. The colour pattern can change in a few minutes from almost white to uniformly dark brown depending on the mood of the fish.

A distinctive bicoloured pattern is seen when two adults or an adult and large juvenile meet. In such instances the smaller fish (which usually turns laterally and swims away) displays a bicoloured pattern, with the dorsolateral parts of the head dark brown or blackish, the ventral parts, caudal peduncle and all fins except the dorsal are white, and there is an oblique white band from the tip of the snout through the eye and continued posteriorly towards the dorsal fin. After turning away, the bicoloured fish usually resumes its "normal" barred pattern in a few seconds. Colin (1992) observed that this bicoloured pattern predominates in aggregations of spawning fishes (both males and females) and suggested that this pattern may indicate a submissive or non-aggressive state that facilitates the peaceful aggregation of these normally solitary, territorial fish.

Geographical Distribution: Western North Atlantic: Bermuda, Florida, Bahamas, Yucatan Peninsula, and throughout the Caribbean to southern Brazil (Fig. 414). Not known from the Gulf of Mexico except at the Campeche Bank off the coast of Yucatan, at Tortugas, and off Key West.

Habitat and Biology: This species is common on shallow coral reefs throughout the West Indies and Caribbean region, with a depth range extending to at least 90 m. Juveniles are common in seagrass beds. Its diet comprises mainly fishes (54%) and crabs (23%), with lesser amounts of other crustaceans and molluscs (Randall, 1967). Juveniles feed mostly on crustaceans, and large adults mostly on fishes (Lee, 1974).

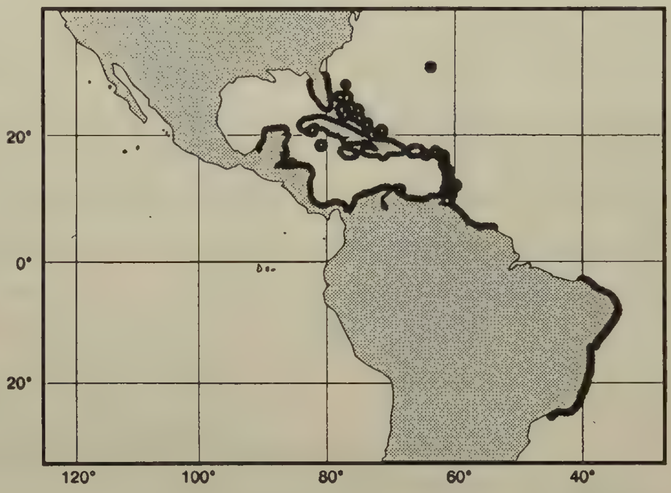


Fig. 414

Spawning aggregations of a few dozen to perhaps as many as 100 000 individuals have been reported from the Bahamas, Jamaica, Cayman Islands, Belize, and the Virgin Islands. Virtually all islands or banks in the Caribbean have, or had in the past, spawning aggregations; unfortunately many have been fished to commercial "extinction." These aggregations occur in depth of 20 to 40 m at specific locations of the outer reef shelf edge in December, January and/or February at or near the time of the full moon (Thresher, 1984; Smith, 1972; Olsen and LaPlace, 1979; Colin et al., 1987; Colin, 1992). During spawning, most fish (males and females) display the bicoloured (non-aggressive) pattern and hover above the bottom. Some females remain in the barred pattern, becoming very dark as mating approaches and were closely followed by bicoloured fish during courtship. The bicoloured fish may also swim in circles beside the dark barred female. Spawning occurs at sunset, in groups of 3 to about 25 fish. Release of gametes is preceded by various movements of the courting groups: vertical spirals, short vertical runs followed by rapidly crowding together then rapidly dispersing, and horizontal runs near the bottom. Mating is initiated by a dark phase fish (presumed female) dashing forward and upward, the female is closely followed by bicoloured males releasing a white cloud of sperm, and other bicoloured fish (presumably females, which are also releasing eggs) (Colin, 1992).

The supposed protogynous mode of grouper reproduction in ***Epinephelus striatus*** is complicated by the recent discovery of some males that have not gone through a previous female stage. These primary males are smaller than the secondary males, which are fish that have spawned one or more times as females and then changed sex (Y. Sadovy and P.L. Colin, personal communication). According to C.L. Smith (1971), females at Bermuda were said to transform to males between 30 and 80 cm standard length. But it now seems possible that the smallest males may have developed directly as adult males, without going through an initial period as functional females.

Eggs and larvae of ***Epinephelus striatus*** that had spawned in captivity were described by Guitart Manday and Fernandez (1966) and Powell and Tucker (1992).

Olsen and LaPlace (1979) studied age and growth and breeding aggregations of ***E. striatus*** at St. Thomas in the Virgin Islands. Their calculated von Bertalanffy growth equation is $L_t = 97.4(1\text{-}e^{-0.183(t+0.488)})$ where Lt is total length in mm and A_{95} (age at which 95% of asymptotic size is attained) = 15.9 years (90 cm standard length). The breeding aggregation at St. Thomas was subjected to increasing fishing pressure for 20 years, and in the 1973-74 season, the catch declined sharply. This decline was attributed to a combination of intense fishing pressure and increased predation by sharks attracted to the breeding aggregation and the struggling fish caught by hook-and-line. The breeding aggregation was observed over coral ridges at a depth of 50 m and comprised a conical mass of 1 000 to 2 000 fish extending upwards about 30 m. The fish at the bottom were actively swimming and exhibited both the bicoloured and normal barred colour patterns; the fish in midwater were stationary.

Size: Attains at least 100 cm total length and 25 kg.

Interest to fisheries: One of the most important food fish in the West Indies and throughout the Caribbean. Caught with hook-and-line and in traps.

Local names: CUBA: Cherna criolla; VENEZUELA: Mero gallina.

Literature: Smith (1971); Bauchot et al. (1984); Colin (1992).

Epinephelus suborbitalis Amaoka and Randall, 1990

Fig. 415

SERRAN Epin 95

Epinephelus suborbitalis Amaoka and Randall, 1990:1, figs 1-5 (type locality: Minami-Koho Seamount, Kyushu-Palau Ridge, western Pacific, 26°10'N, 135°47'E).

Synonyms: ***Epinephelus*** sp. Amaoka in Okamura et al., 1982:374, fig. 148.

FAO Names: **En** - Seamount grouper; **Fr** - Mérou guyot; **Sp** - Mero de Minami-Koho.

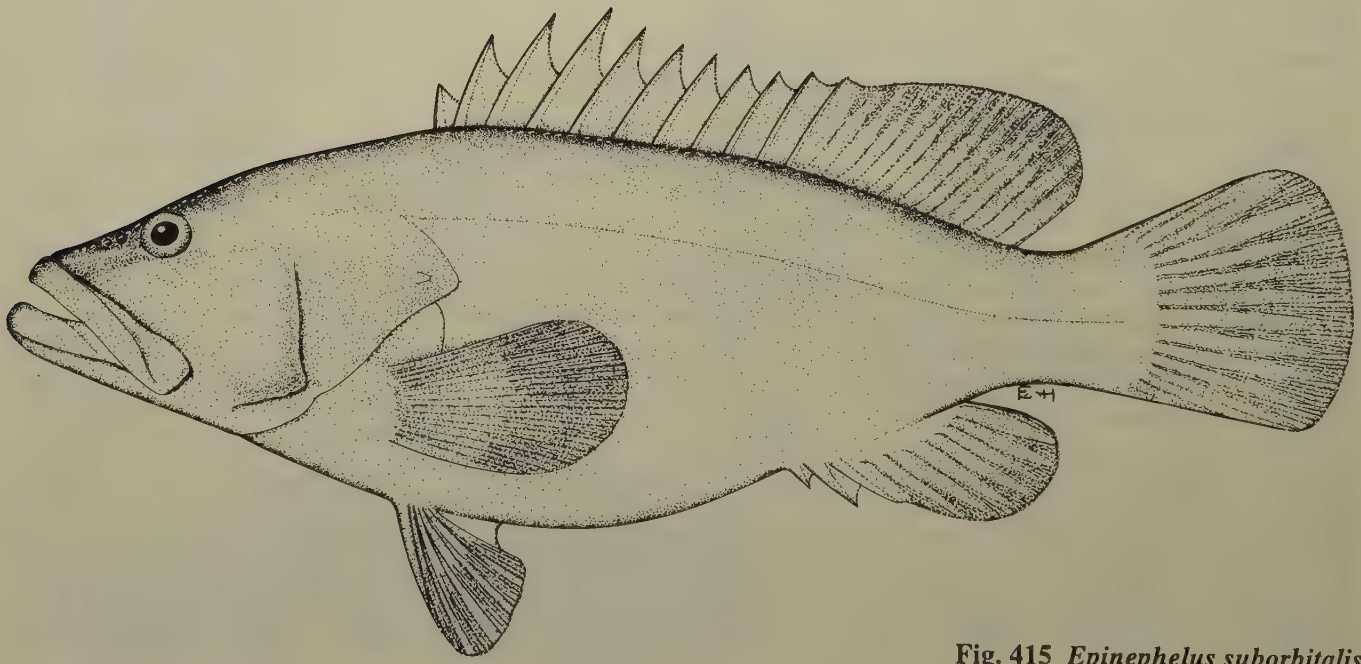


Fig. 415 ***Epinephelus suborbitalis***
(950 mm standard length)

Diagnostic Features: (Known only from a single large adult.) Body robust, the depth contained 2.7 times in standard length (95 cm standard length); body width contained 2.25 times in the depth. Head length contained 2.4 times in standard length; interorbital area slightly convex, the width contained 4.4 times in head length; upper edge of operculum convex; posterior nostril of large adults broadly oval, its diameter about 3 times that of anterior nostril; ventral edge of maxilla with a step-like expansion distally; midlateral part of lower jaw with 3 rows of teeth; inner symphyseal teeth of upper jaw not enlarged. Gill rakers 8 on upper limb, 15 on lower limb. Dorsal fin with XI spines and 14 rays; the fourth spine longest, its length contained 3.1 times in head length, the interspinous membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 19; caudal-peduncle depth contained 3.3 times in head length; caudal fin slightly rounded. Lateral-body scales ctenoid; no auxiliary scales on body; lateral-line scales 63; lateral-scale series 122. **Colour**: Uniform greyish brown, the fins darker.

Geographical Distribution: ***E. suborbitalis*** is known only from Kyushu Palau Ridge south of Japan (Fig. 416).

Habitat and Biology: The only known specimen was collected in a trawl at a depth of 360 to 570 m.

Size: Attains at least 95 cm standard length (118 cm total length).

Interest to Fisheries: None.

Local Names:

Literature: Amaoka and Randall (1990); Okamura et al. (1982) illustrated this specimen in colour.

Remarks: ***E. suborbitalis*** is known only from a single large adult.

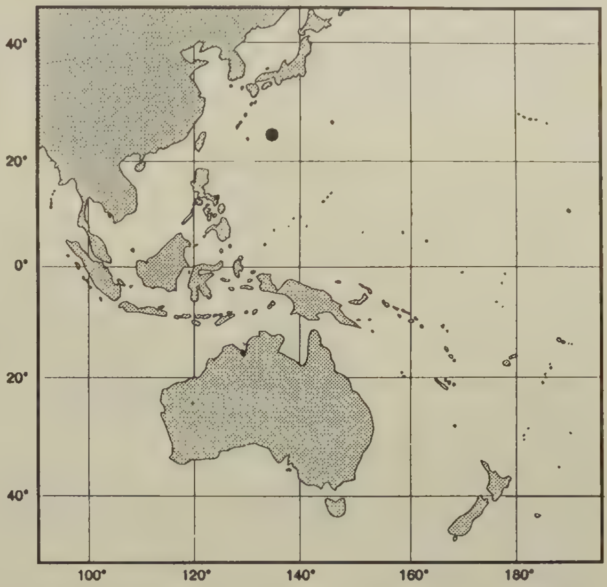


Fig. 416

Epinephelus summana (Forsskål, 1775) | Fig. 417; Pl. XXIIIC | SERRAN Epin 11

Perca summana Forsskål, 1775:xi, 42 (type locality: Red Sea).

Synonyms: ***Serranus leucostigma*** Valenciennes in Cuv. and Val., 1828:346 (type locality: Massaua, Red Sea coast of Arabia). ***Sebastes meleagris*** Peters, 1865c:392 (type locality: Massaua).

FAO Names: **En** - Summan grouper; **Fr** - Mérou summan; **Sp** - Mero sumán.

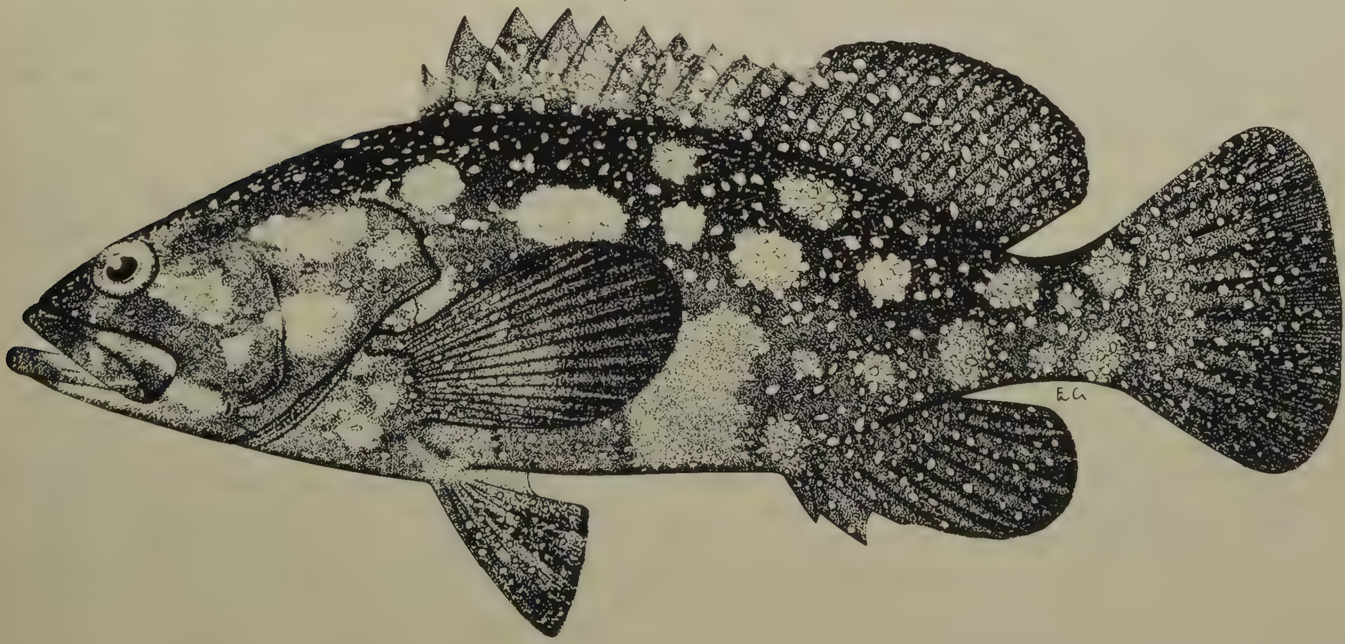


Fig. 417 *Epinephelus summana* (334 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.1 times in standard length (for fish 15 to 43 cm standard length); body width contained 1.8 to 2.3 times in the depth. Head length contained 2.2 to 2.6 times in standard length; interorbital area flat or slightly concave; serrae at corner of preopercle slightly enlarged; upper edge of operculum strongly convex; posterior nostril of adults vertically elongate, its length contained 2 to 4 times diameter of anterior nostril; maxilla extends to vertical at rear edge of orbit; midlateral part of lower jaw with 2 to 4 rows of subequal teeth. Gill rakers 8 to 10 on upper limb, 14 to 17 on lower limb. Dorsal fin with XI spines and 14 to 16 rays, the third or fourth spine longest, its length contained 2.7 to 3.2 times in head length and subequal to longest dorsal-fin rays; interspinous dorsal-fin membranes incised; anal fin with III spines and 8 (rarely 9) rays; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.65 to 2.1 times, pelvic-fin length contained 2.15 to 2.7 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 49 to 54; lateral-scale series 95 to 110. **Colour**: Dark olive-brown to dark brownish grey; head and body with large pale botches (most larger than eye) and numerous small white spots overlying this pattern; on the head the small white spots are confined to the pale blotches; fins covered with small white spots, except for pectoral fins where the white spots are usually confined to the base; black maxillary streak present; blackish brown blotches sometimes visible at base of dorsal fin and on top of peduncle. Juveniles dark grey, with large dark-edged white spots of variable size on head, body, and fins; juveniles less than 4 cm standard length with irregular black bands across pectoral fins.

Geographical Distribution: *E. summana* is known only from the Red Sea and Gulf of Aden (Fig. 418).

Habitat and Biology: Usually found on shallow coral reefs in lagoons or brackish water environments. We have not found any published information on the biology of this species.

Size: Attains 43 cm standard length, 52 cm total length.

Interest to Fisheries: No fishery information for *E. summana* is available. Caught with hook-and-line, spear, and in traps. Sold fresh in local markets.

Local Names:

Literature: Randall (1983); Randall and Ben-Tuvia (1983); Randall and Heemstra (1991).

Remarks: *E. summana* is closely related to the allopatric *E. ongus* of the Indo-west Pacific. Most authors have misidentified *E. ongus* as *E. summana*. *E. ongus* has longer pectoral fins (length 1.4 to 1.7 times in head length), longer pelvic fins (length 2.0 to 2.3 times in head length) and adults do not have the rear nostrils vertically elongated. Also, *E. ongus* has a narrow white margin and broad blackish submarginal band posteriorly on the median fins (these markings are absent or poorly developed in *E. summana*), and the white spots on adult *E. ongus* tend to coalesce posteriorly to form narrow wavy longitudinal stripes.

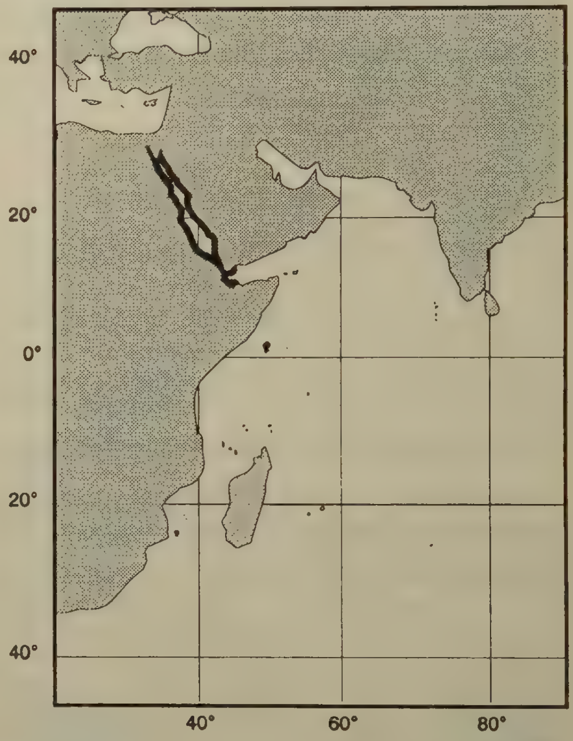


Fig. 418

E. caeruleopunctatus, which does not occur in the Red Sea, is also similar to *E. summana*; it differs in having the upper edge of the operculum straight, sinuous or slightly convex, pectoral-fin rays 17 to 19, and it has only a few white spots on the fins.

Epinephelus tauvina (Forsskål, 1775) Fig. 419; Pl. XXIIID-F SERRAN Epin 12

Perca tauvina Forsskål, 1775:39 (type locality: Jeddah, Red Sea).

Synonyms: ***Holocentrus pantherinus*** Lacepède, 1801:pl. 27, fig. 3; 1802:345, 389 (type locality: Madagascar). ?***Serranus Jansenii*** Bleeker, 1857b:376 (type locality: Sangi Island, Indonesia). ***Serranus Goldiei*** Macleay, 1883a:226 (type locality: Port Moresby, Papua New Guinea). ***Epinephelus elongatus*** Schultz, 1953:331, 345, fig. 53, pl. 25C (type locality: Enewetak Atoll, Marshall Islands). ***Epinephelus chewa*** Morgans, 1966:258, 267, pl. 9, fig. D (type locality: Mafia Id, Tanzania).

FAO Names: **En** - Greasy grouper; **Fr** - Mérou loutre; **Sp** - Mero lutra.

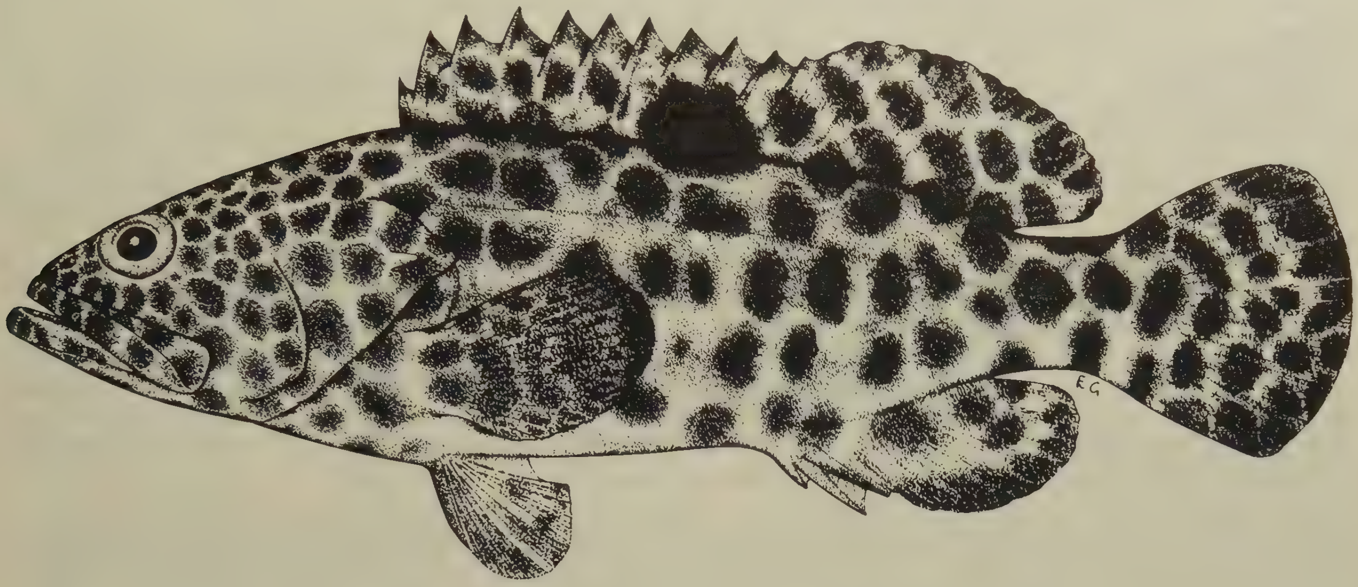


Fig. 419 *Epinephelus tauvina*
(120 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.6 times in standard length (for fish 10 to 61 cm standard length). Head large, its length contained 2.1 to 2.4 times in standard length; snout length contained 2.0 to 2.4 times in upper-jaw length; interorbital area narrow, flat to slightly concave, interorbital width contained 6.8 to 8.1 times in head length and 3.1 to 4.0 times in upper-jaw length; preopercle broadly rounded (not angular), serrae at corner of preopercle slightly enlarged; upper edge of operculum almost straight; posterior nostrils distinctly larger than anterior nostrils; maxilla reaching well past eye, the greatest width about twice suborbital depth (least distance from eye to maxilla), maxilla width 6.8 to 8.1 % of standard length; upper-jaw length 21 to 24 % of standard length, midlateral part of lower jaw with 2 to 5 rows of teeth; inner teeth at symphysis of upper jaw are longer than the fixed canines at front of jaw. Gill rakers 8 to 10 on upper limb, 17 to 20 on lower limb; no bony platelets on side of gill arch. Dorsal fin with XI spines and 13 to 16 rays, the third to fifth spines longest, their length contained 3.1 to 4.7 times in head length and distinctly shorter than longest dorsal-fin rays; interspinous dorsal-fin membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 19, pectoral-fin length contained 1.7 to 2.4 times and pelvic-fin length contained 2.2 to 2.8 times in head length; caudal fin rounded. Midlateral-body scales ctenoid in juveniles; scales smooth in adults, except for small patch covered by pectoral fin; lateral-line scales 63 to 74; lateral-scale series 95 to 112. Pyloric caeca 16 to 18. **Colour**: Head and body pale greenish grey or brown, covered with roundish dark spots that vary from dull orange-red to dark brown, the centres darker than edges; spots on head progressively smaller anteriorly; a large black blotch (or group of black spots) often visible on body at base of last 4 dorsal-fin spines and extending onto lower part of fin; 5 faint subvertical dark bars may be present on body, 4 below dorsal fin and fifth on peduncle (these bars may be represented by dusky blotches at base of dorsal fin and a dark saddle blotch on peduncle); fins also covered with dark spots, those on pectoral fins becoming smaller and less distinct on distal part of fin; posterior margin of caudal, anal and pectoral fins often with white edge; dark spots on soft dorsal, caudal and anal fins of juveniles are so close set that the pale interspaces form a white reticulum.

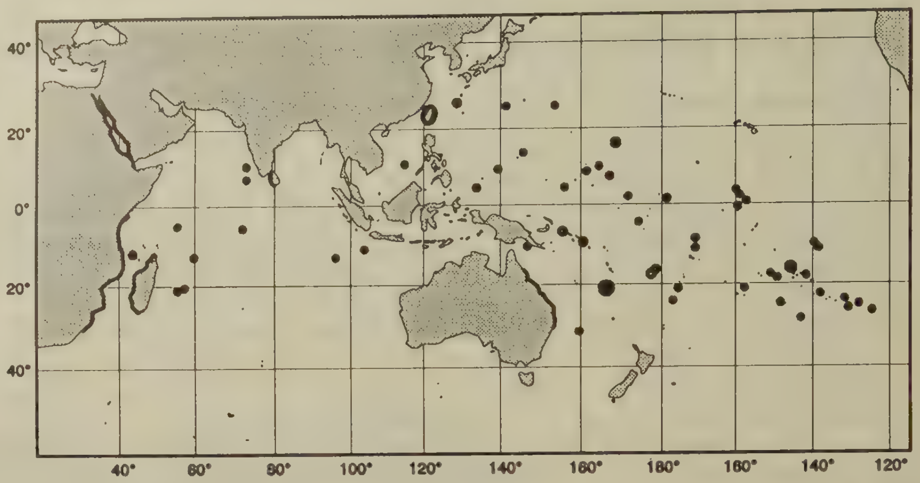


Fig. 420

Geographical Distribution: *E. tauvina* occurs from the Red Sea to South Africa and eastward to Ducie in the Pitcairn Group, the easternmost atoll of Oceania; in the western Pacific it ranges from Japan to New South Wales and Lord Howe Island. *E. tauvina* is more common at islands than along continental shores, but it is also known from continental areas with well-developed coral reefs (e.g., the Gulf of Aqaba). We found no verifiable records or specimens from the Persian Gulf, coast of Asia, the Philippines, Indonesia, northern Australia, and western Australia (Fig. 420). *E. tauvina* was reported from the eastern Mediterranean by Ben-Tuvia and Lourie (1969), but Heemstra (1991) determined that this record was based on specimens of *E. coioides*.

Habitat and Biology: *E. tauvina* prefers clear water areas on coral reefs; juveniles have been taken on reef flats and in tidepools, but adults are found in deeper water (to 50 m). Randall (1980a) found that adults from Oceania were almost exclusively piscivorous; only 1 of 19 fish that contained food had eaten a crab. Fishes eaten comprised holocentrids, a mullid and a pomacentrid. Randall and Heemstra (1991) illustrated a newly transformed juvenile of 26 mm standard length which was collected in April 1972 on the outer reef flat at Enewetak Atoll in the Marshall Islands. This specimen has the second dorsal-fin spine elongated and a large serrated spine (half eye diameter in length) at the corner of the preopercle.

Size: Attains 61 cm standard length (75 cm total length). Reports of sizes in excess of 80 cm total length for *E. tauvina* are probably based on misidentification of *E. coioides*, *E. malabaricus*, and *E. lanceolatus*.

Interest to Fisheries: Where it is abundant *E. tauvina* is certainly of importance to artisanal fisheries, but separate statistics for this species are not available. Caught with hook-and-line, spear, and in traps. Sold fresh in local markets.

Local Names: EASTER ISLAND: Haroa; REUNION: Vielle loutre; TAHITI: Faroa.

Literature: Most of the literature concerning "*E. tauvina*" that was published before 1984 was based on misidentifications of *E. coioides*, *E. malabaricus*, or *E. lanceolatus*. Randall and Ben-Tuvia (1983) incorrectly listed *E. salonotus* Smith and Smith, 1963 as a synonym of *E. tauvina*; this error was corrected by Heemstra and Randall (1984) who recognized *E. salonotus* as a synonym of *E. spilotoceps*. Randall and Heemstra (1991) have discussed the many misidentifications of *E. tauvina*.

Remarks: *E. tauvina* has often been confused with *E. coioides* and *E. malabaricus*; differences between these three species are discussed in the account of *E. malabaricus*.

Juveniles of *E. tauvina*, are sometimes mistaken for the various species of the "reticulated groupers": *E. spilotoceps* differs from *E. tauvina* in having ctenoid body scales; dark spots on head and body closely set, forming a pale reticulum; upper jaw length less than 20% of standard length; and lower gill raker 15 to 17.

E. macrospilos has lateral-line scales 48 to 52, 14 to 17 lower gill rakers, and head length contained 2.3 to 2.6 times in standard length.

E. melanostigma has dark spots on head and body forming a pale reticulum, lateral-body scales ctenoid, and the nostrils are subequal.

E. polyphekadion has the lateral-body scales ctenoid, lateral-line scales 47 to 52, lower gill rakers 15 to 17, pectoral-fin rays 16 to 18, and the ventral parts of head and body covered with small close-set dark spots.

E. fuscoguttatus has the dorsal head profile with an indentation above the eye, body depth contained 2.6 to 2.9 times in standard length, and lateral-line scales 49 to 58.

Differences between *E. tauvina*, *E. coioides*, and *E. malabaricus* are given in the account of *E. malabaricus*.

Epinephelus timorensis Randall and Allen, 1987

Fig. 421; Pl. XXIVA

SERRAN Epin 96

Epinephelus timorensis Randall and Allen, 1987:393, 399, fig. 2 (type locality: Dillon Shoals, Western Australia).

Synonyms: ***Epinephelus*** sp. Wass, 1984:12 (Tutuila, American Samoa).

FAO Names: **En** - Yellowspotted grouper; **Fr** - Mérou taches jaunes; **Sp** - Mero de pintas amarillas.

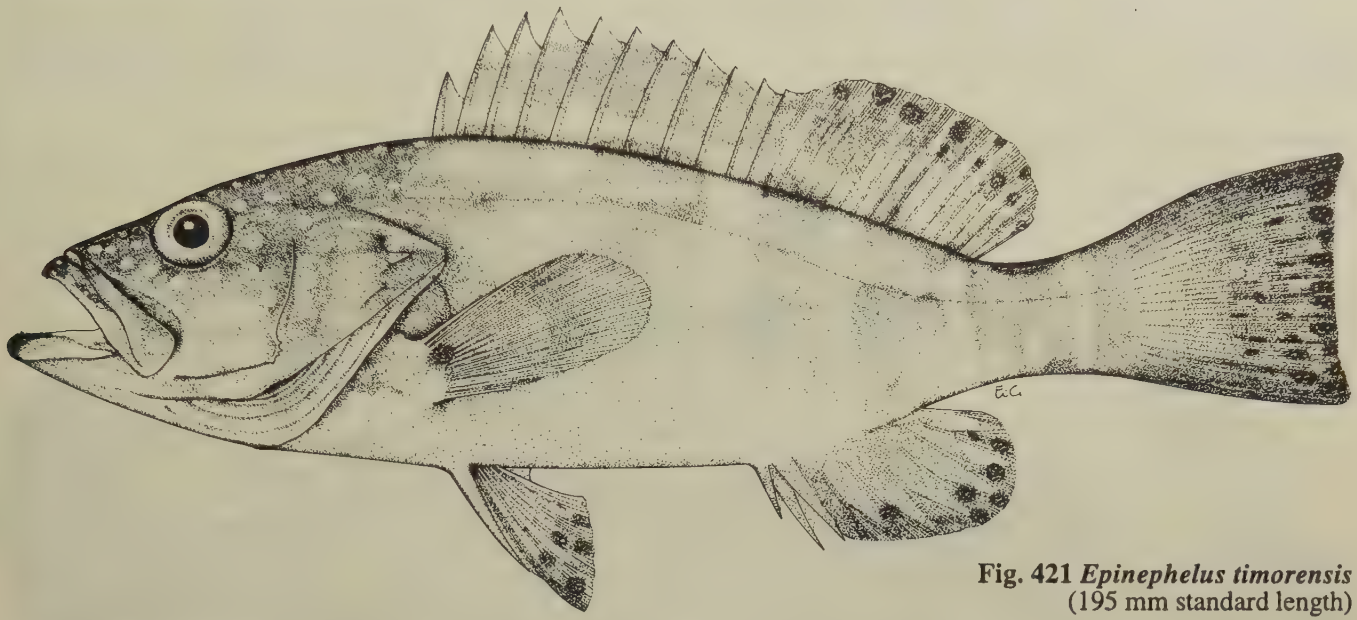


Fig. 421 ***Epinephelus timorensis***
(195 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.4 times in standard length (for fish 14 to 27 cm standard length). Head length 2.4 to 2.7 times in standard length; interorbital area flat to convex; preopercle corner with 2 to 4 distinctly enlarged serrae; upper edge of operculum straight or nearly so; nostrils small, subequal; maxilla extends to below rear half of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 or 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the fourth spine longest, its length 2.7 to 3.0 times in head length and subequal to longest dorsal-fin rays, the interspinous membranes incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 or 18; pectoral-fin length 1.6 to 1.8 times in head length; pelvic-fin length 1.8 to 2.1 times in head length; caudal fin of adults truncate or emarginate, but slightly rounded in juveniles. Lateral-body scales distinctly ctenoid, with auxiliary scales; lateral-line scales 49 to 53; lateral-scale series 97 to 108. Pyloric caeca 13 or 14. **Colour**: Head and body pale brownish grey; yellow or golden brown spots on head, nape and chest; spots on snout smaller than those on operculum; a row of dark yellowish brown spots along margin of soft dorsal and anal fins and rear edge of caudal fin; caudal fin of 141 mm juvenile covered with close-set dark spots, the pale interspaces forming a white reticulum; adults with 5 faint, irregular, dark bars or series of dark blotches on body, the first 4 bars extending into dorsal fin; pectoral-fin rays pale yellowish, the membranes transparent; pelvic fins streaked with yellowish brown and whitish, with a few yellowish brown spots distally.

Geographical Distribution: The known distribution of ***E. timorensis*** is wide ranging but very sparse: Western Australia, American Samoa (Tutuila), and the Phoenix Islands (Canton Island) (Fig. 422). The apparent rarity of this species is probably a result of its deep-water habitat and the fact that it was only recently described as a new species.

Habitat and Biology: ***E. timorensis*** is known from depths of 73 to 210 m off coral reefs. Nothing has been published on the biology of this rare species.

Size: Attains at least 27 cm standard length (32 cm total length).

Interest to Fisheries: None.

Local Names:

Literature: Randall and Heemstra (1991).

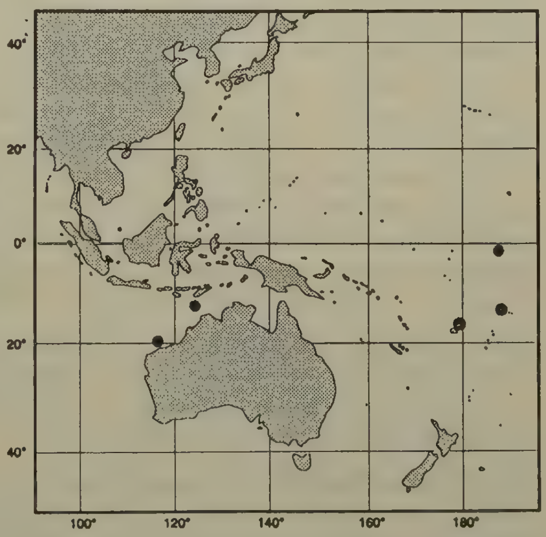


Fig. 422

Remarks: *E. timorensis* is vaguely similar to ***E. bleekeri***, which has the lower two-thirds of the caudal fin dusky or blackish, the orange-yellow spots extend all over the body (except ventrally) and dorsal fin, and more gill rakers (9 to 11 on upper limb and 16 to 18 on lower limb).

Epinephelus trimaculatus (Valenciennes, 1828)

Fig. 423; Pl. XXIVB

SERRAN Epin 97

Serranus trimaculatus Valenciennes in Cuv. and Val., 1828:331 (type locality: Japan).

Synonyms: *Serranus ura* Valenciennes in Cuv. and Val., 1828:332 (type locality: Japan). *Serranus Ara* Temminck and Schlegel, 1842:9 (unjustified emendation of *Serranus ura* Valenciennes).

FAO Names: **En** - Threespot grouper; **Fr** - Mérou trois taches; **Sp** - Mero de tres manchas.

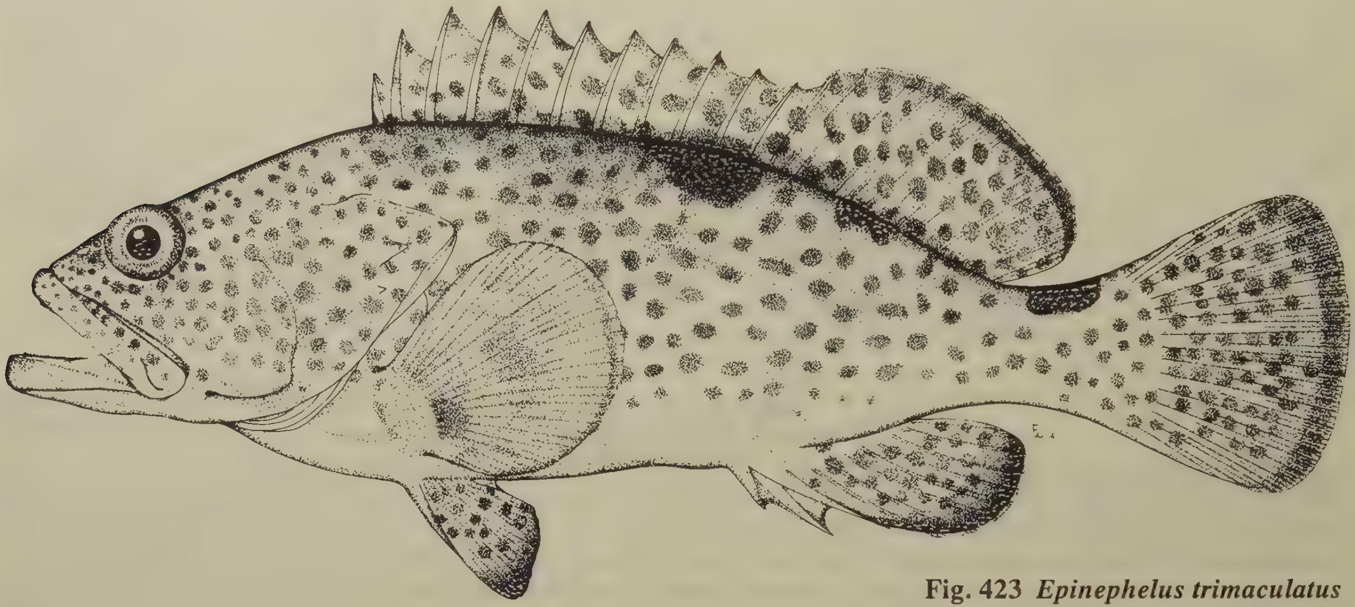


Fig. 423 ***Epinephelus trimaculatus***
(254 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.3 times in standard length (for fish 14 to 27 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital area slightly convex; preopercle rounded, the serrae mostly hidden by skin; upper edge of operculum straight; nostrils small, subequal; maxilla reaches to or past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 7 to 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.7 to 3.5 times in head length and shorter than longest dorsal-fin rays; anal fin with III spines and 8 rays; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.7 to 2.0 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.5 times in head length; caudal fin rounded. Midlateral-body scales of adults (28 cm standard length) smooth; juveniles with patch of ctenoid scales on area covered by pectoral-fin tip; lateral-line scales 48 to 52; lateral-scale series 88 to 100. Pyloric caeca 27 to 36. **Colour**: Head and body pale brown, covered (except ventrally) with small red or reddish brown spots; median fins darker, but also covered with dark reddish brown spots and often with a narrow white edge; a black blotch larger than eye on body at base of last 3 dorsal-fin spines, a smaller blotch at base of middle dorsal-fin rays and a third on top of caudal peduncle; paired fins yellowish, with a few small faint orange spots.

Geographical Distribution: *E. trimaculatus* is known only from Japan, Korea, Taiwan, and China (Fig. 424). Reports of this species (or "*Epinephelus fario*") from the Indian Ocean are apparently based on misidentifications.

Habitat and Biology: According to Chan (1968), juveniles are common in tidepools and in shallow clear water around rocks and coral reefs. Adults are found in deeper water.

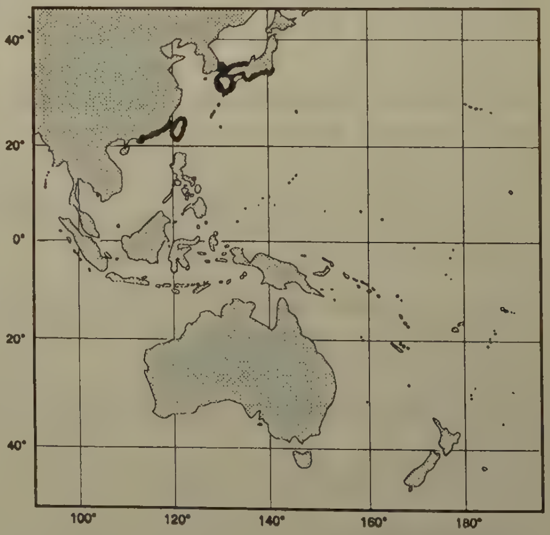


Fig. 424

Size: Attains 40 cm standard length (50 cm total length).

Interest to Fisheries: *E. trimaculatus* is an important food fish in Japan and Hong Kong. Kuo et al. (1988) induced sex reversal and artificial spawning in "*Epinephelus fario*." Caught with vertical longlines and handlines.

Local Names: HONG KONG: Black-saddled grouper, Huk-dim-hung-paan; JAPAN: Nominokuchi.

Literature: Randall and Heemstra (1991).

Remarks: Several recent authors have used the name *Epinephelus fario* (Thunberg, 1793b) for this species, but Bauchot et al. (1984) regarded Thunberg's original description and figure of *Perca fario* as unidentifiable, and there is no type specimen.

Epinephelus trophis Randall and Allen, 1987

Fig. 425

SERRAN Epin 98

Epinephelus trophis Randall and Allen, 1987:402, fig. 3 (type locality: Dillon Shoals, Western Australia).

Synonyms: None.

FAO Names: **En** - Plump grouper; **Fr** - Mérou rondelet; **Sp** - Mero rollizo:

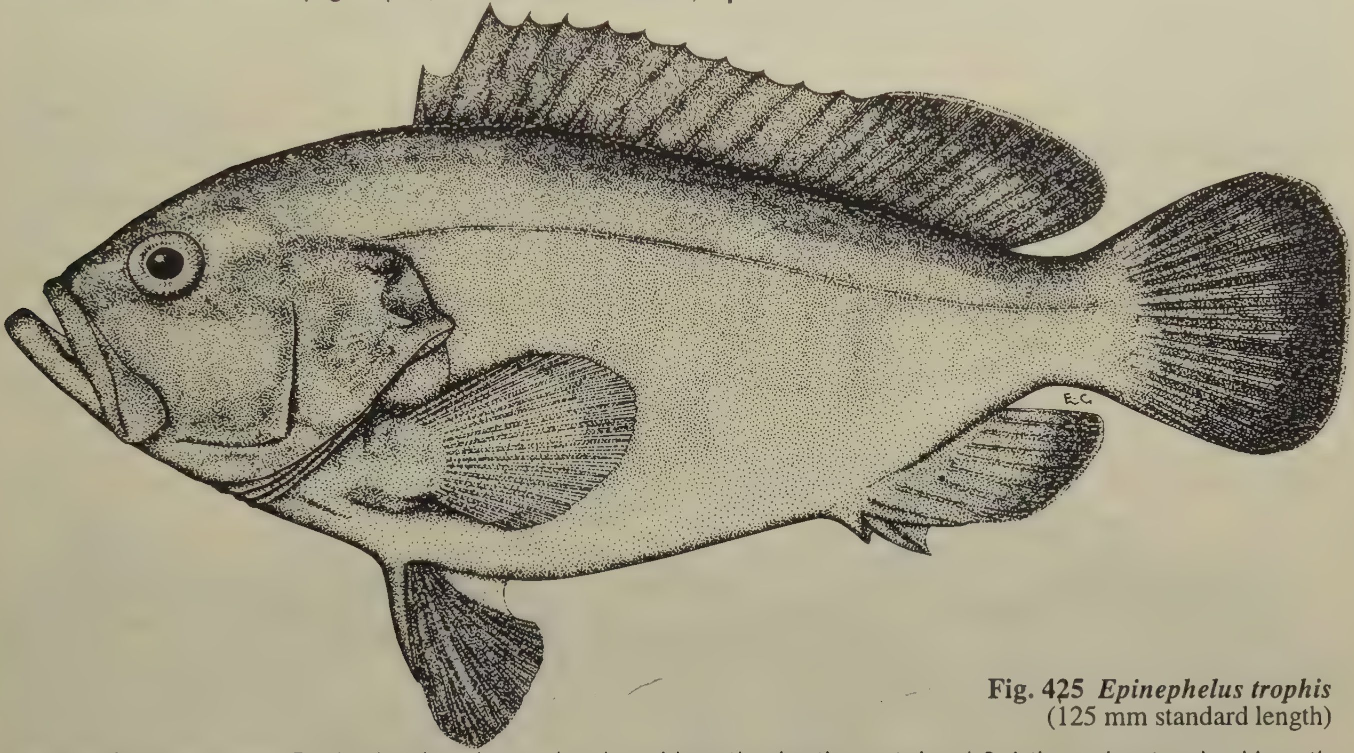


Fig. 425 ***Epinephelus trophis***
(125 mm standard length)

Diagnostic Features: Body depth subequal to head length, depth contained 2.4 times in standard length (2 fish of 104 and 126 mm standard length). Interorbital area convex; preopercle corner with 2 or 3 enlarged serrae; upper edge of operculum convex; nostrils small, subequal; maxilla reaches vertical at rear edge of orbit; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 10 on upper limb, 15 or 16 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the fourth spine longest, its length contained 2.8 to 2.9 times in head length and shorter than longest dorsal-fin rays, the interspinous membranes slightly incised; anal fin with III spines and 8 rays; pectoral-fin rays 17 or 18; pelvic fins not reaching anus; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.9 to 2.0 times in head length; caudal fin convex. Lateral-body scales ctenoid; no auxiliary scales; lateral-line scales 67 to 69; lateral-scale series 143 to 145. **Colour**: Head, body, and median fins dark charcoal grey; pectoral fins pale; pelvic fins blackish.

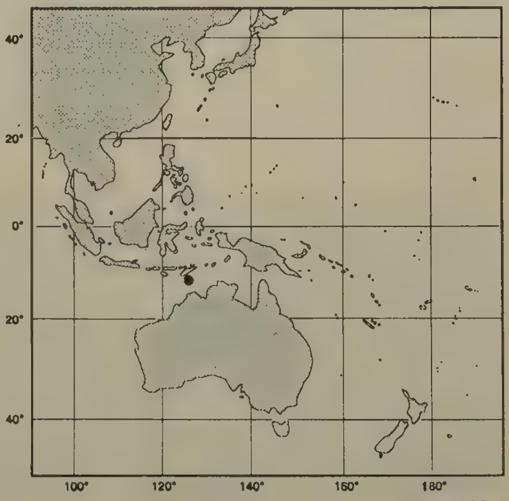


Fig. 426

Geographical Distribution: Known only from Dillon Shoals in the Timor Sea off Western Australia (Fig. 426).

Habitat and Biology: The only two specimens known were collected from the base of a drilling rig at a depth of 130 m.

Size: The largest of the two known specimens is 126 mm standard length (15 cm total length).

Interest to Fisheries: None.

Local Names:

Literature: Randall and Allen (1987).

Remarks: *E. trophis* is very similar to *E. flavocaeruleus*. The interspinous dorsal-fin membranes are not (or only slightly) incised and the meristic and morphometric data are virtually the same for both species. Comparing 3 small (112, 127, and 145 mm standard length) *E. flavocaeruleus* with the 105 and 126 mm type specimens of *E. trophis*, it appears that the caudal fin is more truncate in *E. flavocaeruleus* (although it is convex when spread open in the 112 mm fish), the caudal peduncle is slightly longer (length 17 to 20% of standard length versus 16% of standard length in *E. trophis*) and the pelvic fins reach to or within 3 mm of the anus (8 mm from anus in the 126 mm *E. trophis*). Of course these minor differences may be an artefact of the small number of specimens that are available for comparison. *E. trophis* and *E. flavocaeruleus* differ notably in colour; juveniles of *E. flavocaeruleus* have the fins and jaws bright yellow. If colour pattern is the only significant difference between these two species, *E. trophis* may represent a Western Australian subspecies of *E. flavocaeruleus*, which is not known from Australia.

Epinephelus tuamotuensis Fourmanoir, 1971

Fig. 427; Pl. XXIVC

SERRAN Epin 99

Epinephelus tuamotuensis Fourmanoir, 1971:127, fig. 1 (type locality: Rangiroa, Tuamotu Archipelago).

Synonyms: None.

FAO Names: **En** - Reticulate grouper; **Fr** - Mérou réseau; **Sp** - Mero reticular.

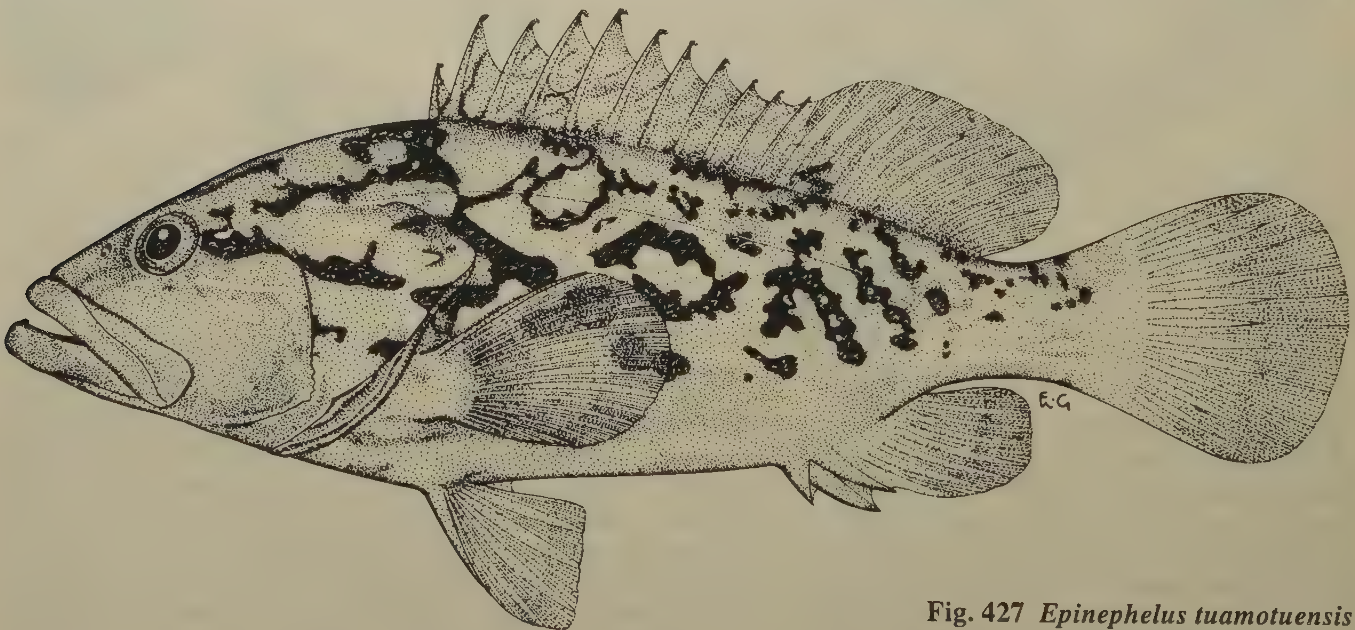


Fig. 427 ***Epinephelus tuamotuensis***
(398 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 2.9 times in standard length (for fish 11 to 32 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area convex; preopercle subangular, with 3 or 4 distinctly enlarged serrae at the angle; upper edge of operculum straight or nearly so; posterior nostrils larger than anterior ones; maxilla reaches almost to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth, the inner teeth larger; canine teeth at front of jaws well developed. Gill rakers 9 to 11 on upper limb, 16 or 17 on lower limb. Dorsal fin with XI spines and 15 rays, the fourth or fifth spine longest, its length contained 3.0 to 3.3 times in head length and almost equal to longest dorsal-fin ray; interspinous dorsal-fin membranes deeply incised; anal fin with III spines and 8 rays; pectoral-fin rays 17, the fins not fleshy; pectoral-fin length contained 1.9 to 2.1 times in head length; pelvic fins not reaching anus, their length contained 2.2 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid; a few auxiliary scales on adults (40 cm standard length); lateral-line scales 60 to 64; lateral-scale series 143 to 145. **Colour**: Pale yellowish brown with an irregular coarse reticulum of dark brown on body and rear part of head (some sections of the network are broken, and there may be small pale spots with the dark bands); fins unmarked.

Geographical Distribution: *E. tuamotuensis* is known only from the Tuamotu Islands, Society Islands, Pitcairn Group, and Rapa (Fig. 428).

Habitat and Biology: This grouper occurs on the outer slope of coral reefs in depths of 120 to 250 m. Fourmanoir (1971) found ophichthid eels (*Leiuranus phoenixensis*) in the stomachs of his type specimens.

Size: Attains at least 66 cm standard length.

Interest to Fisheries: Probably of some importance in artisanal fisheries, but not commonly caught because of its preference for deep water.

Local Names: EASTER ISLAND: Kito, Matuvi; TUAMOTU ISLANDS: Snakeskin seabass.

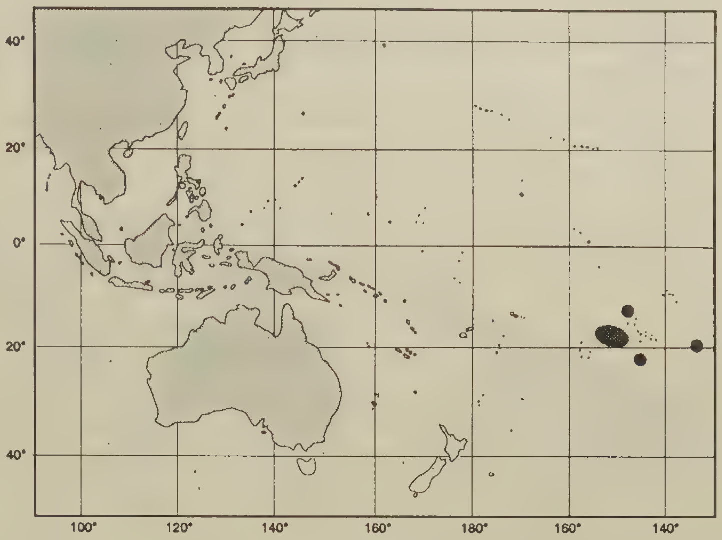


Fig. 428

Literature: Bagnis et al. (1972, misidentified as *E. morrhua*); Randall and Heemstra (1991).

Remarks: *E. tuamotuensis* is a member of the *E. morrhua* species-complex, which also includes *E. poecilonotus* and *E. radiatus*. These 4 species are often misidentified, and we can find no meristic or morphological characters that will separate them. These deep-water groupers are characterized by having the body depth less than head length, 2 to 5 distinctly enlarged serrae at corner of preopercle, 2 rows of teeth at sides of lower jaw, dorsal-fin rays 13 to 15, pectoral fins not fleshy, pelvic-fin length contained 2.0 to 2.8 times in head length, lateral-line scales 54 to 66, and the colour pattern dominated by curving dark bands or longitudinal series of dark spots. The other 3 species of this *E. morrhua* species-complex are *E. poecilonotus*, *E. radiatus* and *E. tuamotuensis*. These 4 species have often been confused, and we can find no meristic or morphological characters that will distinguish them.

E. morrhua has dark bands running from the head up to the dorsal fin and another dark band (more or less continuous) from head to caudal peduncle; it also often has small dark spots in the pale areas between the dark bands.

Juveniles of *E. poecilonotus* have a large dark brown or black saddle blotch on body at base of spinous dorsal fin; this blotch is isolated from other dark bands on the body and extends over front half of spinous dorsal fin; in adults this blotch breaks up into small dark spots, as do the dark bands on the body, and in large adults most of the dark spots and bands have disappeared; juveniles with a dark band from eye to lower opercular spine, continued as a dark curving midlateral stripe or series of spots to a dark saddle blotch on peduncle. On adults, the triangular interspinous dorsal-fin margins are brownish yellow or gold.

Juveniles of *E. radiatus* have 5 irregular, solid, dark brown bands (with age only the edges remain dark) that run down and forward from dorsal edge of body, the first from nape to eye, the second from base of middle dorsal-fin spines to upper end of gill opening, the third and fourth dark bands from anterior and posterior dorsal-fin rays, both branching as they pass ventrally, and the last dark band on caudal peduncle; with growth, the dark bands break into spots and disappear ventrally on adults; soft dorsal fin and dorsal part of caudal fin densely spotted.

Epinephelus tukula Morgans, 1959

Fig. 429; Pl. XXIVD

SERRAN Epin 56

Epinephelus tukula Morgans, 1959:651, pl. 17, pl. 19 (type locality: Mafia Island, Tanzania).

Synonyms: *Serranus dispar* variety A Playfair in Playfair and Günther, 1867:7, pl. 1, fig. 2 (type locality: Seychelles).

FAO Names: **En** - Potato grouper; **Fr** - Mérou patate; **Sp** - Mero patata.

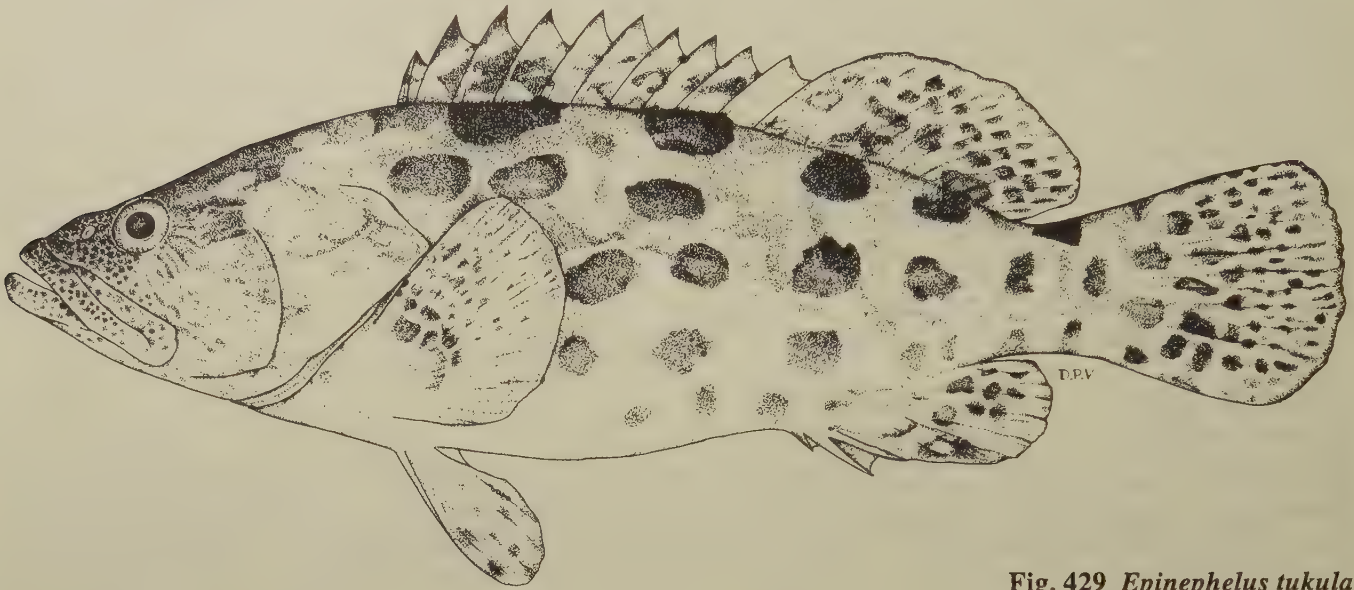


Fig. 429 ***Epinephelus tukula***
(320 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.5 times in standard length (for fish 12 to 41 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area slightly convex; the dorsal head profile straight; preopercle rounded or subangular, the serrae at corner slightly enlarged; upper edge of operculum almost straight; nostrils subequal; maxilla reaches to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 to 6 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 18 on lower limb. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 3.1 to 3.8 times in head length and distinctly shorter than longest dorsal-fin rays; interspinous dorsal-fin membranes distinctly incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 to 20; pectoral-fin length contained 1.6 to 2.1 times in head length; pelvic fins usually not reaching anus, their length contained 1.9 to 2.4 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales in adults; lateral-line scales 62 to 70; lateral-scale series 113 to 130. **Colour**: Body pale brownish grey with several dark brown to black widely-spaced blotches, mostly larger than eye and varying in shape from round to oval or dumbbell-shaped; head with smaller dark brown spots and streaks (many radiating from eye, especially posteriorly); dark spots on fins, smaller distally. Large adults may be nearly black.

Geographical Distribution: *E. tukula* occurs from the western Indian Ocean and Red Sea to the western Pacific. It is known from Egypt, Djibouti, Kenya, Tanzania, Mozambique, South Africa (Natal), Seychelles, southern Oman, Pakistan, India, Japan (Okinawa and Honshu), Taiwan, South China Sea (Paracel Islands), Western Australia, and Queensland (Fig. 430). This species does not occur in the Persian Gulf, and there are no records for Madagascar, Réunion, Mauritius, Maldives, Laccadives, Sri Lanka, Andaman Islands, Christmas Island (Indian Ocean), Indonesia, the Philippines, and New Guinea.

Habitat and Biology: *E. tukula* is a coral-reef species; juveniles may be found in tidepools, and adults occur in depths of 10 to 150 m. Morgans (1959) estimated that maturity occurs at 90 cm

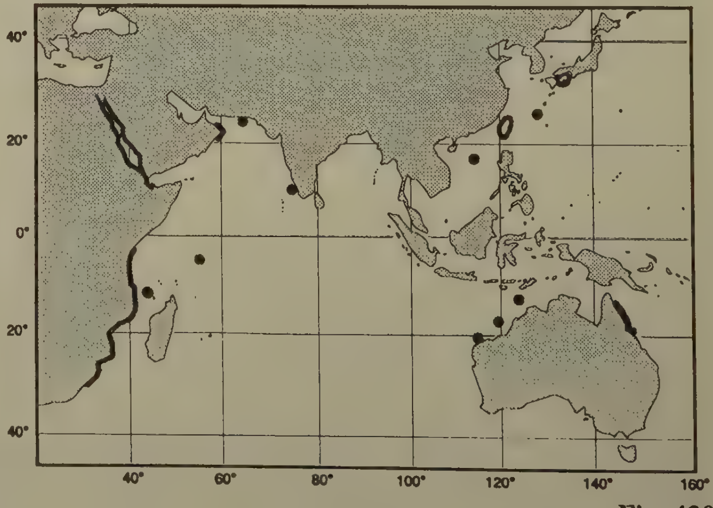


Fig. 430

standard length, and in a later paper (Morgans, 1982) he reported a ripe female of 955 mm standard length. Morgans (1959) reported "Stomachs contained fish remains almost exclusively but one cephalopod beak was found." According to van der Elst (1981) *E. tukula* eats a wide variety of reef fishes, skates, crabs and spiny lobsters; he also reported that this species is "exceedingly territorial, and is very aggressive towards unwelcome intruders." The large size and territorial behaviour of *E. tukula* makes it especially vulnerable to spearfishermen, hence spearfishing for this species is illegal in South African waters.

Size: *E. tukula* is one of the largest species of grouper known; it attains at least 150 cm total length and 90 kg. According to van der Elst (1988), it attains 200 cm total length.

Interest to Fisheries: Although *E. tukula* is not common, it is an important species in the sportfishery of South Africa and Australia. Caught with hook-and-line and spear.

Local Names: AUSTRALIA: Potato cod; JAPAN: Kasurihata; SEYCHELLES: Vieille tukula; SOUTH AFRICA: Potato bass.

Literature: Randall (1990); Randall and Heemstra (1991).

Remarks: The absence of *E. tukula* at most of the Indian Ocean islands is puzzling. The distinctive colour pattern makes *E. tukula* easy to identify and difficult to confuse with other species of groupers. The name "potato grouper" refers to the potato-shaped dark blotches on the body.

Epinephelus undulatostriatus (Peters, 1867)

Fig. 431; Pl. XXIVE

SERRAN Epin 76

Serranus undulatostriatus Peters, 1867:518 (type locality: Sydney, Australia).

Synonyms: *Serranus guttulatus* Macleay, 1879:33, pl. 2 (type locality: Port Jackson [Sydney], New South Wales).

FAO Names: **En** - Maori grouper; **Fr** - Mérou maori; **Sp** - Mero Maori.

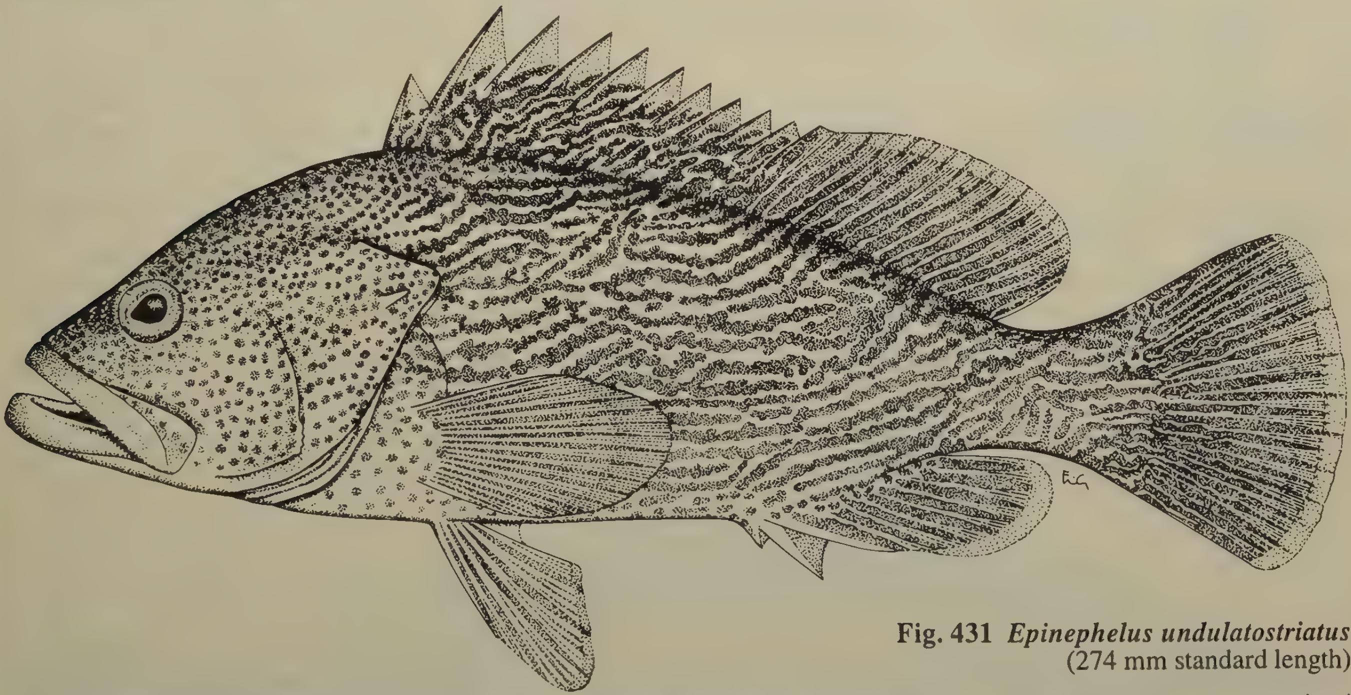


Fig. 431 *Epinephelus undulatostriatus* (274 mm standard length)

Diagnostic Features: Body depth contained 2.5 to 2.9 times in standard length (for fish 11 to 39 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area convex, the dorsal head profile almost straight; preopercle subangular, the serrae at corner slightly enlarged; upper edge of operculum almost straight; nostrils subequal; maxilla reaches to or slightly past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 9 or 10 on upper limb, 15 or 16 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the third or fourth spine longest, its length contained 2.2 to 2.8 times in head length and longer than longest dorsal-fin rays; interspinous dorsal-fin membranes distinctly incised; anal fin with III spines and 8 rays; pectoral fins fleshy, with 17 to 19 rays; pectoral-fin length contained 1.6 to 2.0 times in head length; pelvic fins not reaching anus (except in small juveniles), pelvic-fin length contained 1.8 to 2.0 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 55; lateral-scale series 98 to 108. Pyloric caeca 11. **Colour:** Body buff, covered with close-set wavy longitudinal brownish orange, golden brown, or reddish brown stripes; some stripes broken into series of small spots; head pale greyish brown, covered with small spots like those on body; maxillary streak orange-brown; fin rays pale, with small brown spots, the interradial membranes dark brown; median fins with narrow yellow margin; pectoral fins diffusely yellow distally. According to Marshall (1964), the ground colour of juveniles is lavender.

Geographical Distribution: *E. undulatostriatus* is endemic to Australia, from southern Queensland (most northern record, One Tree Island, Great Barrier Reef at 23°30'S) to Bateman's Bay (35°44'S) New South Wales (Fig. 432). One specimen was reported from Kangaroo Island, South Australia.

Habitat and Biology: Coral reefs and rocky areas in depths of 27 to 80 m. *E. undulatostriatus* is an active swimmer that will leave the bottom to take a floating bait.

Size: Attains 61 cm total length, 5 kg.

Interest to Fisheries: *E. undulatostriatus* is an esteemed food fish and important species in the hook-and-line fishery of Australia's east coast. Caught with hook-and-line and spear.

Local Names: AUSTRALIA: Maori cod, Red-speckled rock-cod.

Literature: Marshall (1964); Randall and Heemstra (1991).

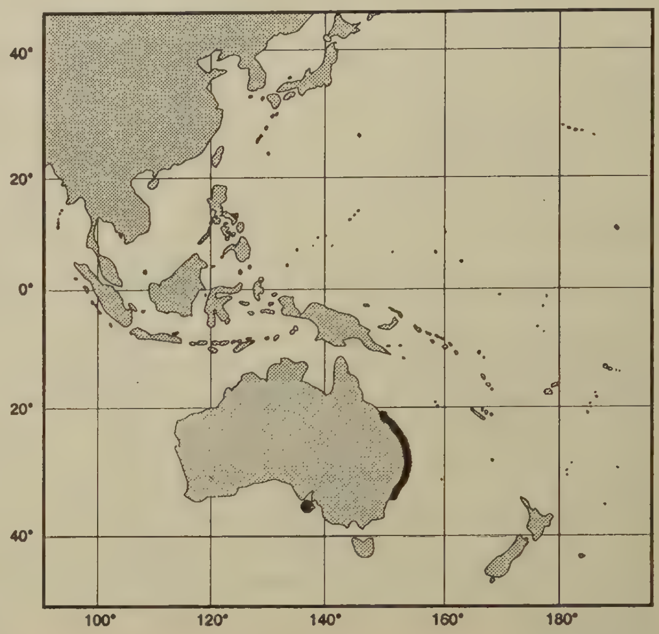


Fig. 432

Remarks: Colour illustrations of *E. undulatostriatus* were published by Deas (1971), Parish (1974), Coleman (1980), Grant (1975, 1982, 1987), Randall (1990), Randall and Heemstra (1991).

Epinephelus undulosus (Quoy and Gaimard, 1824)

Fig. 433; Pls XXVIF, XXVA

SERRAN Epin 57

Bodianus undulosus Quoy and Gaimard, 1824:310 (type localities: Waigeo [off north coast of New Guinea] and "Rawak" [= ?Sarawak]).

Synonyms: ***Serranus lineatus*** Valenciennes in Cuv. and Val., 1828:312 (type locality: Pondicherry, India). ***Serranus amboinensis*** Bleeker, 1852a:258 (type locality: Ambon, Indonesia).

FAO Names: **En** - Wavy-lined grouper (formerly: Midwater grouper); **Fr** - Mérou ondulé; **Sp** - Mero ondulado.

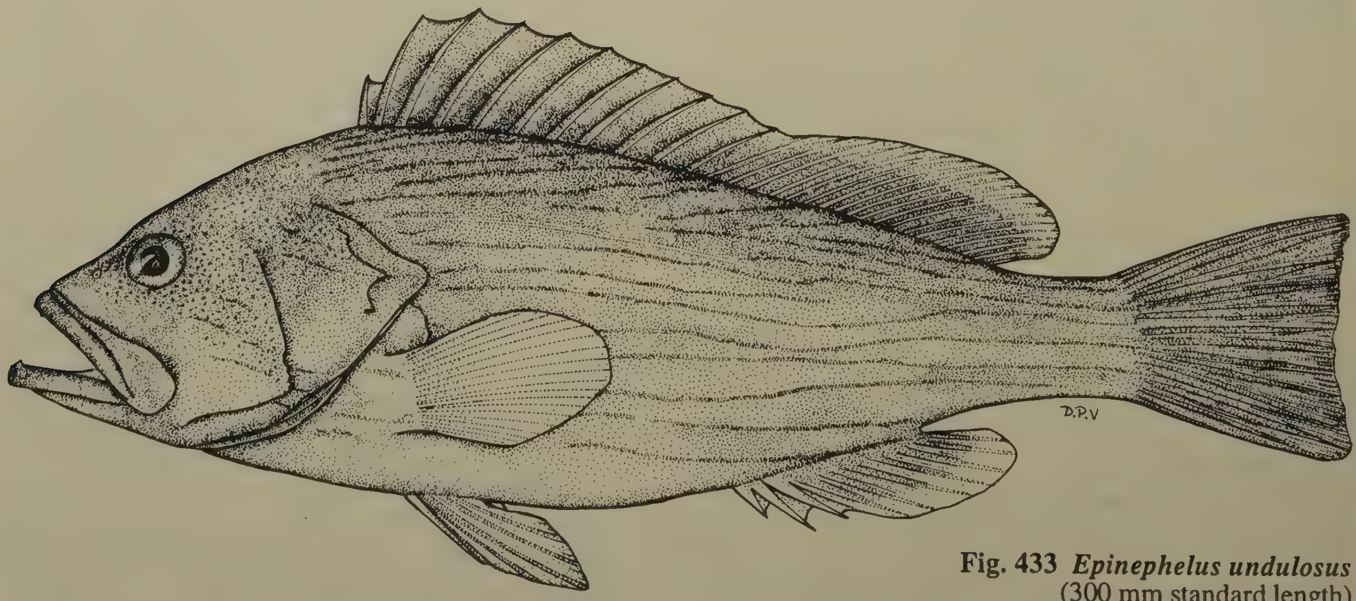


Fig. 433 *Epinephelus undulosus* (300 mm standard length)

Diagnostic Features: Body depth contained 2.7 to 3.1 times in standard length (for fish 11 to 60 cm standard length). Head length contained 2.5 to 2.7 times in standard length; interorbital area convex; preopercle angular, with a notch above the corner and the serrae at the corner enlarged; upper edge of operculum straight or slightly concave; nostrils subequal or the posterior ones slightly larger; maxilla reaches to vertical at rear edge of eye; adults with a prominent knob or hook-like process on ventral edge of maxilla (covered by upper lip); midlateral part of lower jaw with 2 rows of teeth. Gill rakers longer and more numerous than other species of ***Epinephelus***, 12 to 16 on upper limb, 20 to 23 on lower limb; total 32 to 38; 1 or 2 rudimentary rakers in juveniles, but none in adults. Dorsal fin with XI spines and 17 to 19 rays, the third or fourth spine longest, its length contained 2.5 to 3.4 times in head length and longer than longest dorsal-fin ray; interspinous membranes of dorsal fin not incised; anal fin with III spines and 8 rays; pectoral-fin rays 18 or 19; pectoral fins shorter than pelvic fins, pectoral-fin length contained 1.7 to 2.3 times in head length; pelvic fins not reaching anus (except for juveniles), pelvic-fin length contained 1.6 to 2.2 times in head length; caudal fin truncate to emarginate. Lateral-body scales distinctly ctenoid, with numerous auxiliary scales; lateral-line scales 63 to 76; lateral-scale series 124 to 150. **Colour**: Head, body, and fins purplish grey to brownish grey, with brown to golden-brown dots on head and wavy longitudinal lines of the same colour on dorsal part of body (lines faint or absent on large specimens); margin of spinous dorsal fin narrowly blackish.

Geographical Distribution: ***E. undulosus*** occurs in the northern Indian Ocean (Kenya, Somalia, Yemen, Gulf of Oman, Gulf of Aden, Laccadive Islands, India, Sri Lanka, and the Andaman Islands), and it is also known from Indonesia, Sarawak, New Guinea, Papua New Guinea, Solomon Islands, and the Philippines (Fig. 434). It has not been reported from the Red Sea, Persian Gulf, or Australia.

Habitat and Biology: ***E. undulosus*** is found on banks (rather than coral reefs) at depths of 24 to 90 m. According to Morgans (1982), it feeds on a variety of small fishes, small crustaceans (especially stomatopods), shrimp, and pelagic tunicates (*Thalia* and *Pyrosoma* sp). Females were estimated to be mature at 46 cm standard length (55 cm total length).

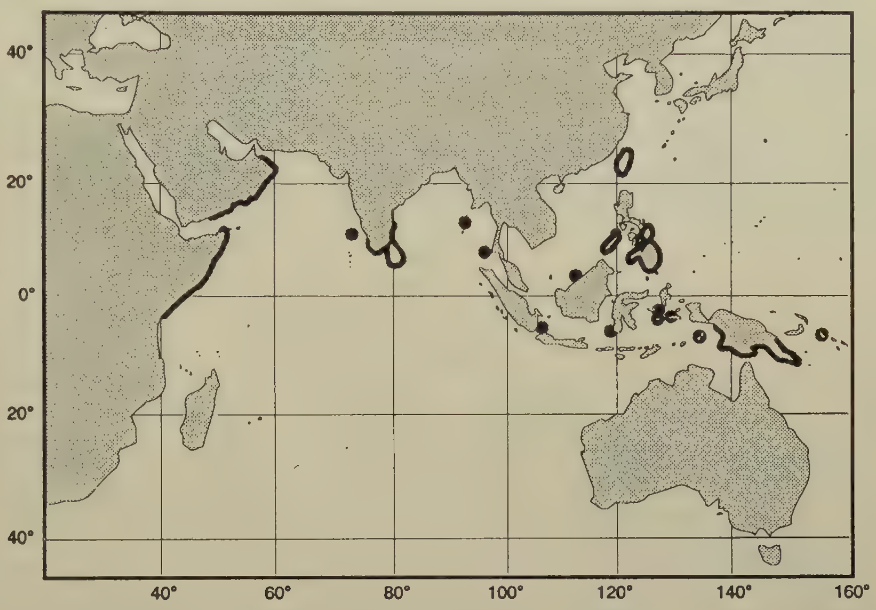


Fig. 434

Size: Attains at least 73 cm total length, 6.4 kg. According to Talwar and Kacker (1984), ***E. undulosus*** attains a length of 122 cm total length.

Interest to Fisheries: ***E. undulosus*** is (or was) common on the North Kenya Banks off Lamu and in the Wadge Bank trawl fishery off the west coast of Sri Lanka (Morgans, 1964, 1982). Talwar and Kacker (1984) reported that this species is of some importance in the fishery along the Tamil Nadu coast of India. Caught with hook-and-line, vertical longlines, and with trawls.

Local Names: INDIA (Marathi): Hekaru, Gobra; KENYA: Seyu (Lamu).

Literature: Randall and Heemstra (1991).

Remarks: Although the gill rakers of ***E. undulosus*** are more numerous and longer than the gill rakers of any other species of ***Epinephelus***, its diet (as reported by Morgans, 1982) is not different from that of other species of groupers. It is a generalized predator that usually feeds on a variety of fishes and crustaceans that live on or near the bottom. Like other groupers, it will take macrozooplankton (e.g., pelagic tunicates) if such prey are available.

E. undulosus also differs from most other groupers in its high number of dorsal-fin rays and the well-developed bony knob or hook on the ventral edge of the maxilla.

Gonioplectrus Gill, 1862

SERRAN Gonio

Gonioplectrus Gill, 1862:236; type species, ***Plectropoma hispanum*** Cuvier, by monotypy.

Synonyms: None.

Species: A single species, known from the western Atlantic and Caribbean.

Remarks: The relationships of the monotypic genus ***Gonioplectrus*** are unclear. It is a *bona fide* member of the Epinephelinae, with 10 precaudal and 14 caudal vertebrae, one supernumerary spine on the first dorsal-fin pterygiophore, well-developed supramaxilla, inner teeth of jaws depressible, proximal third of inner pelvic-fin ray attached by membrane to body, and larva with the second dorsal-fin spine and pelvic-fin spine elongated and serrate. It differs from other groupers in having the dorsal part of the cranium exposed (not covered by skin or scales) and rugose, without crests; the middle opercular spine extends to the rear edge of the operculum and is 2.7 to 2.9 times longer than the other opercular spines; it also lacks the scaly flap of skin that joins the upper pectoral-fin rays to the body. Unlike the postlarvae that are known for other groupers, the 13 mm standard length postlarva of ***Gonioplectrus*** has the third dorsal-fin spine greatly elongated, almost as long as the second spine.

Although it shares with ***Saloptia*** and ***Plectropomus*** a preopercle with a large antrorse spine (or spines) on the lower edge and a short dorsal fin (base less than 50% of standard length) with only VIII spines and 11 to 13 rays, ***Gonioplectrus*** does not seem to be closely related to these genera. It has two well-developed supraneurals (only 1 in ***Saloptia*** and ***Plectropomus***), 15 branched caudal-fin rays (versus 13), prominent knob on lower corner of maxilla (no knob), and the cranium is quite different (see above).

Gonioplectrus hispanus (Cuvier, 1828)

Fig. 435; Pl. XXVB

SERRAN Gonio 1

Plectropoma hispanum Cuvier in Cuv. and Val., 1828:396 (type locality: Martinique).

Synonyms: None.

FAO Names: **En** - Spanish flag; **Fr** - Pavillon espagnol; **Sp** - Bandera español.

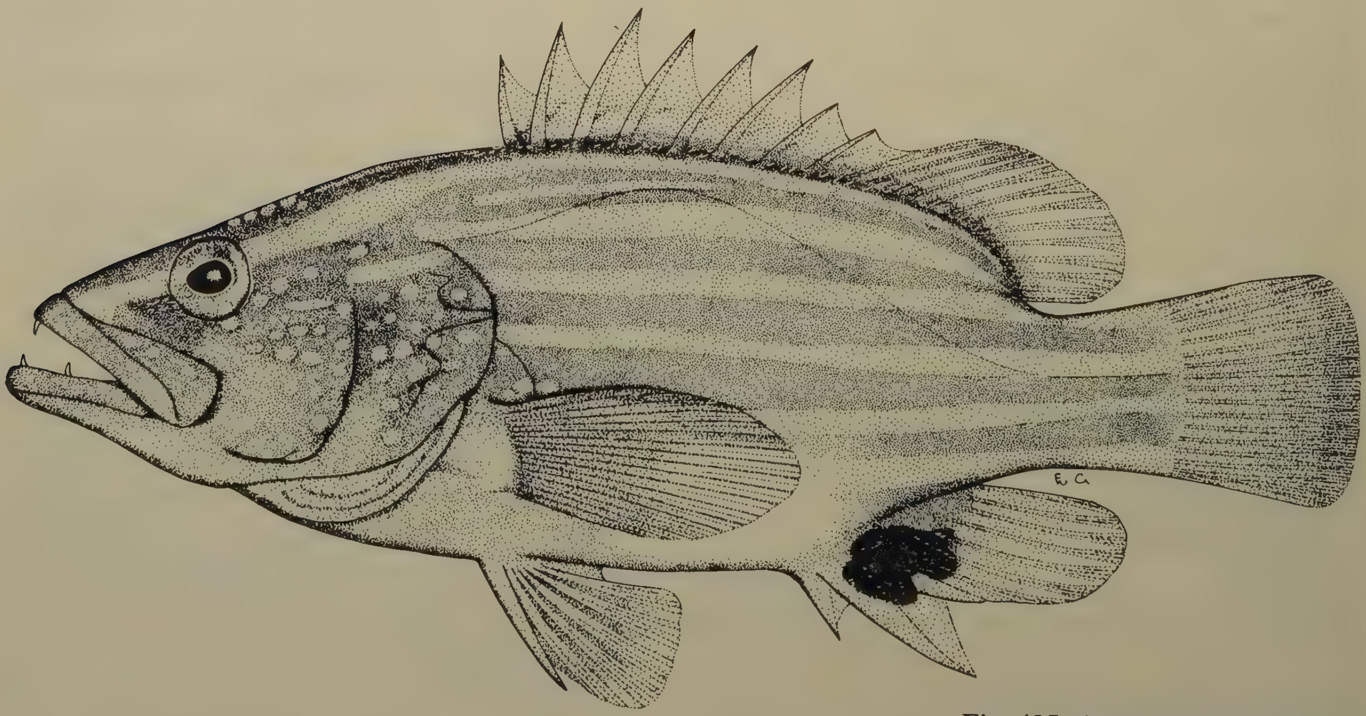


Fig. 435 ***Gonioplectrus hispanus***
(110 mm standard length)

Diagnostic Features: Body depth subequal to head length, depth contained 2.3 to 2.5 times in standard length (for fish 13 to 20 cm standard length), the body width contained 2.3 to 2.4 times in body depth. Head length contained 2.2 to 2.3 times in standard length; interorbital area convex, the dorsal head profile convex; top of head rugose; preorbital depth contained about 12 times in head length; preopercle rounded, with a large, curved (antrorse) spine at the angle, the lower edge fleshy; middle opercle spine very large, extending to or beyond rear edge of opercular membrane; subopercle and interopercle with a few minute serrae; nostrils small, subequal; maxilla with a well-developed supramaxilla and a prominent bony knob (hidden by upper lip) on lower rear corner; jaws with a band of minute, slender, depressible teeth, the inner teeth near symphysis enlarged; a short, curved, fixed canine tooth on each side of symphysis of both jaws and 1 to 3 similar fixed canines at midside of lower jaw; 2 rows of minute teeth on vomer and palatines. Gill rakers 5 to 7 on upper limb, 16 on lower limb, the longest slightly longer than longest gill filaments. Dorsal fin with VIII spines and 13 rays, the fin origin over upper end of pectoral-fin base, the third or fourth spine longest; interspinous membranes deeply incised, their proximal part fleshy, covered with scales; base of spinous part of fin longer than soft-rayed part; anal fin with III well-developed spines and 7 rays; pectoral fins symmetrically rounded, with 16 or 17 rays, the middle rays longest; pelvic fins reach anus; caudal fin truncate, with 8 branched rays and 7 procurrent rays in upper part and 7 branched rays and 7 procurrent rays in lower part. Lateral line distinctly curved upward below spinous dorsal fin. Scales on body large, distinctly ctenoid and without auxiliary scales; lateral-line scales 47 to 49; 5 rows of scales between lateral line and base of sixth dorsal-fin spine; lateral-scales series 78 to 83; no scales on top of head, preorbital, snout, maxilla or lower jaw. Supraneural bones straight, the second almost as long as the first but noticeably thinner; epipleural ribs on vertebrae 1 to 9; dorsal fin with 9, anal fin with 5, trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore slightly indented at tip of third neural spine; dorsal part of cranium rugose; no crests on frontals; supraoccipital crest low, not continued onto frontals. **Colour**: Head, body, dorsal, and caudal fins yellow; 6 or 7 salmon coloured stripes from head to soft dorsal and caudal fins; blood-red blotch on front half of anal fin; white blotch on side of belly; pelvic fins pinkish purple.

Geographical Distribution: Western Atlantic from off North Carolina (pelagic post-larva, possibly drifted north from Florida or the Bahamas) to the Gulf of Mexico, Caribbean, and south to Vitoria, Brazil (Fig. 436).

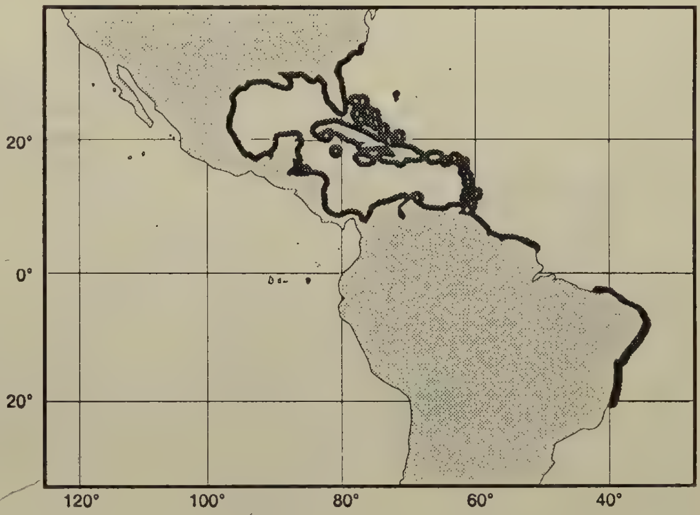


Fig. 436

Habitat and Biology: Reported from rocky bottom in depths of 60 to 365 m. No information is available on the biology of this species.

Size: Attains at least 23 cm standard length.

Interest to Fisheries: *Gonioplectrus* is not important as a food fish, because of its rarity and small size. With its beautiful colours, the Spanish flag could be a valuable fish in the aquarium trade, but its deep habitat would make it difficult to keep alive after capture.

Local Names: MEXICO: Biajaiba.

Literature: Colin (1974); Robins and Ray (1986); Bullock and Smith (1991).

Remarks: Kendall and Fahay (1979) described a postlarva and suggested that *Gonioplectrus* was more closely related to the Epinephelinae than to the Anthiinae. Johnson and Keener (1984) illustrated the unique configuration of transverse ridges on the second dorsal- and pelvic-fin spines of the postlarva.

Gracila Randall, 1964

SERRAN Gracil

Gracila Randall, 1964:281; type species, ***Cephalopholis albomarginatus*** Fowler and Bean, 1930, by original designation and monotypy.

Synonyms: None.

Species: The genus *Gracila* comprises a single species.

Remarks: The definition and relationships of *Gracila* were recently considered by Smith-Vaniz et al. (1988). We agree with their decision to recognize *Gracila* as a monotypic genus.

Gracila albomarginata (Fowler and Bean, 1930)

Fig. 437; Pl. XXVC,D

SERRAN Gracil 1

Cephalopholis albomarginatus Fowler and Bean, 1930:235, fig. 11 (type locality: Danawan Island, Borneo).

Synonyms: None.

FAO Names: En - Masked grouper (formerly: Red-edged grouper); **Fr** - Mérou bord rouge; **Sp** - Mero paranjero.

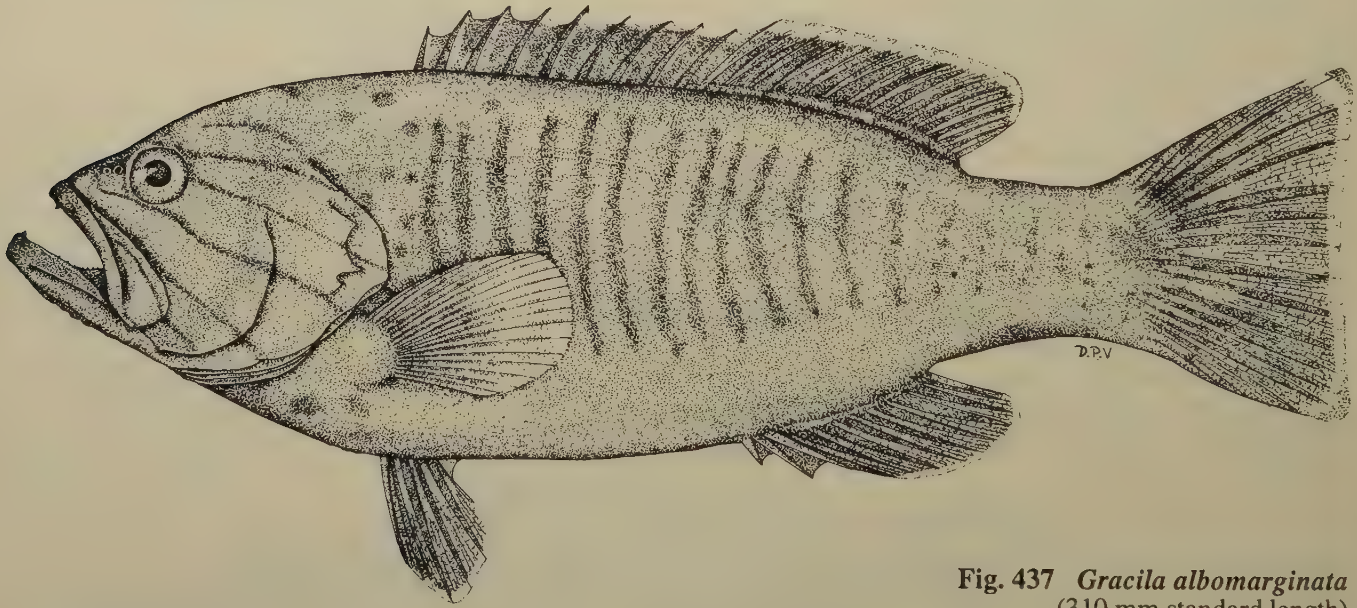


Fig. 437 *Gracila albomarginata*
(310 mm standard length)

Diagnostic Features: Body oblong, somewhat compressed, the depth contained 2.6 to 3.3 times in standard length, the body width contained 1.8 to 2.3 in the depth. Head smaller than most other groupers, head length contained 2.9 to 3.2 in standard length; dorsal head profile evenly convex; interorbital area slightly convex, its width greater than eye diameter; preorbital narrow, its depth distinctly less than eye diameter, preorbital depth contained 10 to 15 times in head length; preopercle rounded, finely serrate, the lower edge smooth and fleshy; ventral edge of subopercle and interopercle smooth; middle opercular spine located one-third distance from lower to upper spine, the upper edge of operculum distinctly convex; nostrils subequal; posterior part of maxilla in adults with a hook-shaped or step-like expansion on ventral edge; supramaxilla well developed; jaws with a pair of small canines at the front; palatine teeth present; midside of lower jaw with 2 rows of teeth, the inner teeth depressible and twice as long as outer teeth. Gill rakers 8 to 10 on upper limb, 14 to 16 on lower limb. Dorsal fin with IX spines and 14 to 16 rays, the fin origin over rear end of operculum; dorsal-fin membranes not (adults) or slightly (juveniles) incised between the spines, dorsal-fin spines slender, the dorsal-fin spines not much thicker than the dorsal-fin rays; anal fin with III spines and 9 or 10 rays, anal-fin spines slender; pectoral fins rounded, with 18-19 rays, the middle rays longest; pectoral fins slightly longer than pelvic fins; pelvic fins not reaching anus; caudal fin truncate to slightly emarginate, with 8 branched rays and 9 to 10 procurrent rays in upper part and 7 branched rays and

9 to 10 procurrent rays in lower part. Midlateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 66 to 76; lateral-scale series 101 to 114. Supraneural bones distinct, the posterior one more than half length of first one; epipleural ribs on vertebrae 1 to 9; dorsal fin with the posterior 3 to 5 pterygiophores trisegmental; posterior 3 to 4 pterygiophores of anal fin trisegmental; rear edge of first dorsal-fin pterygiophore not excavated for tip of third neural spine; cranium broad, its greatest width more than half its length; least interorbital width more than 25% of cranium length; supraoccipital crest and parietal crests not extending onto frontals; frontopterotic ridges extend past midpoint of orbit; mesethmoid pit deep and cancellous; parietals with a prominent lateral process extending posteriorly over the pterotic bone. **Colour**: Adults greenish or reddish brown to brownish grey, with several narrow curved dark bars on midlateral part of body and dark brown spot midlaterally on caudal peduncle; 3 to 5 blue lines (often broken into spots) across the head (the upper 2 lines may serve as margins for a mask-like dark band from snout to end of opercle, enclosing the eye); region under maxilla and along edge of gill opening often orange; soft dorsal and anal fins with narrow blue margin; upper and lower edges of caudal fin darker than rest of fin. A transient colour phase has the caudal peduncle white, with a prominent black spot, and a large white area flanked by black areas on dorsal part of body. Juveniles brown or violet, with a bright reddish orange stripe in dorsal and anal fins and along upper and lower edges of caudal peduncle and fin.

Geographical Distribution: *G. albomarginata* occurs from northern Mozambique to French Polynesia. In the western Pacific it ranges from Okinawa to the northern Great Barrier Reef. Most records are from islands and offshore coral reefs, including Zanzibar, Comoros, Seychelles, Chagos, Mauritius, Réunion, Maldives, Cocos-Keeling Islands, Christmas Island (Indian Ocean), Rowley Shoals, and Scott Reef off Western Australia, Indonesia, Philippines; Taiwan, Papua New Guinea, New Britain, New Caledonia, Society Islands, Phoenix Islands, Marshall Islands, Minami Tori Shima, Guam, Caroline Islands, Palau Islands, Loyalty Islands, Samoa Islands, Takaroa, Tuamotus, and Fanning Island (Fig. 438). Not known from the Red Sea or Persian Gulf.

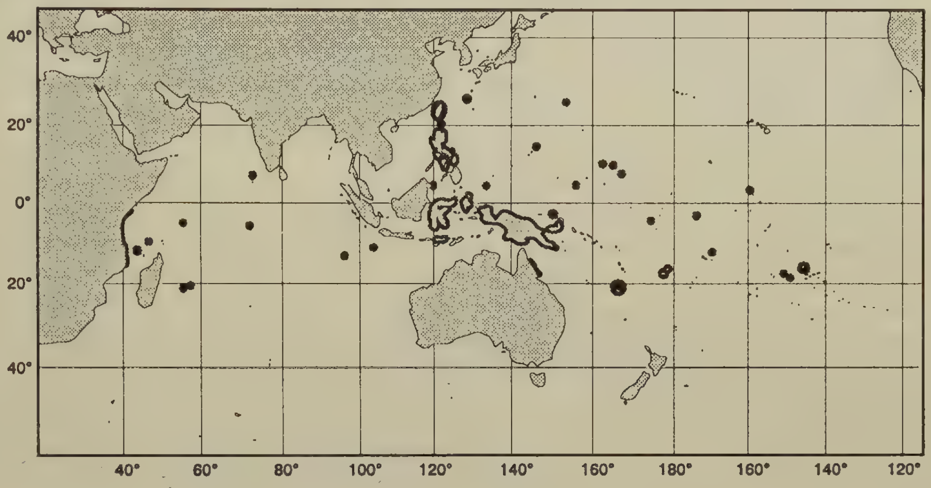


Fig. 438

Habitat and Biology: *G. albomarginata* is an active swimmer that roams over the reef; it is usually found on the outer reef slope in depths of 15 to 120 m. It is an uncommon and (like most groupers) usually solitary species, but Myers (1989) reports occasional sightings of groups of 3 or 4 fish. A specimen speared at the Society Islands had fish remains in its stomach.

Size: Attains at least 38 cm total length (50 cm total length, according to Fourmanoir and Laboute, 1976).

Interest to Fisheries: *G. albomarginata* is an excellent food-fish, but it is not common enough to be of commercial importance. Caught with hook-and-line and gillnets.

Local Names: AUSTRALIA: Thinspine grouper; CAROLINE ISLANDS: White-margined grouper; JAPAN: Tatesuji-hata; KIRIBATI ISLANDS: White-margined grouper; MARSHALL ISLANDS: White-margined grouper; NEW CALEDONIA: Loche a bords blancs.

Literature: Smith-Vaniz (1989); Randall and Heemstra (1991).

Remarks: In addition to *G. albomarginata*, most species of groupers with a truncate or emarginate caudal fin (*Mycteroperca* spp. and *Plectropomus* spp.) are actively swimming fishes that are primarily piscivorous.

Mycteroperca Gill, 1863

SERRAN Myct

Mycteroperca Gill, 1863:236; type species, ***Serranus olfax*** Jenyns by subsequent designation of Gill, 1866:105.

Synonyms: ***Trisotropis*** Gill, 1866:104; type species, ***Johnius guttatus*** Bloch and Schneider (=***Mycteroperca venenosa***), by original designation. ***Parepinephelus*** Bleeker, 1876:257; type species, ***Serranus acutirostris*** Valenciennes, (=***Mycteroperca acutirostris***) by monotypy. ***Archoperca*** Jordan and Evermann, 1896:1171; type species, ***Mycteroperca boulengeri*** Jordan and Starks (=***Mycteroperca xenarcha***) by monotypy. ***Xystroperca*** Jordan and Evermann, 1896:1169; type species, ***Mycteroperca pardalis*** Gilbert (=***Mycteroperca rosacea***) by monotypy.

Diagnostic Features: Body oblong, the depth less than head length and contained 2.7 to 3.6 times in standard length. Head length contained 2.5 to 3.0 times in standard length; snout distinctly longer than eye diameter; dorsal head profile evenly convex; interorbital area convex, the width greater than eye diameter in fish more than 20 cm standard length; preorbital depth less than eye diameter, preorbital depth contained 8 to 13 times in head length; preopercle finely serrate, the serrae at corner enlarged or not; upper edge of operculum convex; rear nostrils equal to or distinctly larger than anterior nostrils; distal part of ventral edge of maxilla straight, no knob, distinct step or hook; supramaxilla well developed; lower jaw projecting in front of upper jaw; well-developed canines at front of jaws; teeth present on palatines. Dorsal fin with XI spines and 15 to 18 rays; anal fin with III spines and 10 to 13 rays; pectoral fins rounded, with 15 to 18 rays, the middle rays longest; caudal fin truncate, emarginate or distinctly concave, with 8 branched rays and 9 to 12 procurrent rays in upper part and 7 branched rays and 9 to 12 procurrent rays in lower part. Midlateral-body scales ctenoid. Supraneural bones 2, the second one distinctly smaller than the first; epipleural ribs on first 10 vertebrae; no trisegmental pterygiophores supporting dorsal- or anal-fin rays; cranial crests well developed, the frontoparietal crests parallel, joining supraorbital ridge; anterior ends of frontals contiguous, meeting transverse wall of supraethmoid; supraoccipital crest not carried forward onto frontals; interorbital width greater than vomer width; parasphenoid straight.

Habitat and Biology: Adults occur on coral reefs and rocky bottoms in depths of 12 to 200 m; juveniles occur in shallow rocky areas, seagrass beds and in estuaries. Except for the ***Mycteroperca rubra*** species-complex (***M. acutirostris***, ***M. fusca*** , and ***M. rubra***, which may feed on macro-zooplankton), adults feed almost exclusively on fishes; juveniles eat mainly invertebrates (primarily crustaceans).

Geographical Distribution: Tropical and subtropical waters of the Atlantic and eastern Pacific oceans; in the western Atlantic, some species of ***Mycteroperca*** range from Massachusetts and Bermuda to southern Brazil. In the eastern Atlantic, the genus is represented by two species: ***M. rubra***, known from the Mediterranean to the Bay of Biscay and along the west coast of Africa south to Angola, and ***M. fusca*** which occurs at Madeira, the Azores, and the Canary and Cape Verde Islands. In the eastern Pacific, species of ***Mycteroperca*** range from southern California (one unconfirmed report of ***M. xenarcha*** from San Francisco Bay) to Peru and the Galapagos.

Interest to Fisheries: The species of ***Mycteroperca*** are of considerable importance to commercial and recreational fisheries.

Species: We recognize 15 species: 2 in the eastern Atlantic, 8 in the western Atlantic and 5 in the eastern Pacific. Heemstra (1991) discussed the taxonomy of the ***M. rubra*** species-complex.

Remarks: The genus ***Mycteroperca*** appears to be closely related to ***Epinephelus***. Species of both genera have XI dorsal-fin spines and lack the trisegmental pterygiophores in the dorsal and anal fins and the terminal knob on the lower corner of the maxilla that are characteristic of species of ***Cephalopholis***.

Key to the Eastern Pacific Species of *Mycteroperca*

1a. Total developed gill rakers 21 to 26; no exserted caudal-fin rays; soft dorsal-fin margin rounded; anal-fin margin angular or pointed (rounded in small juveniles) (Fig. 439) (southern California, Gulf of California) . . . . *M. jordani*

1b. Total developed gill rakers 24 to 43 . . . . → *2*

2a. Gill rakers 24 to 29; adults with second and third dorsal-fin spines elevated, distinctly longer than fifth spine; caudal-fin margin entire (Fig. 440) (Cocos and Galapagos Islands) . . . . . . *M. olfax*

2b. Gill rakers 29 to 43; third to tenth dorsal-fin spines subequal . . . . → *3*

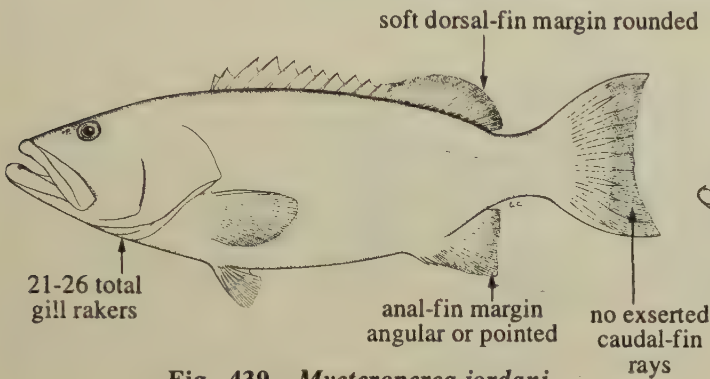

soft dorsal-fin margin rounded
21-26 total gill rakers
anal-fin margin angular or pointed
no exserted caudal-fin rays

Fig. 439 *Mycteroperca jordani*

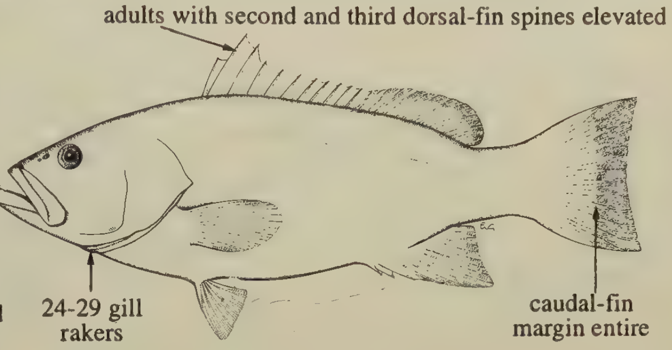

adults with second and third dorsal-fin spines elevated
24-29 gill rakers
caudal-fin margin entire

Fig. 440 *Mycteroperca olfax*

3a. Gill rakers 29 to 33; pectoral-fin rays 16 to 18; caudal-fin rays exserted; body uniform greyish brown or greyish green, with irregular dark oval blotches enclosing a pale line (Fig. 441) (southern California to Peru) . . . . *M. xenarcha*

3b. Total developed gill rakers 34 to 43; pectoral-fin rays 15 to 17; colour not as in 3a . . . . → *4*

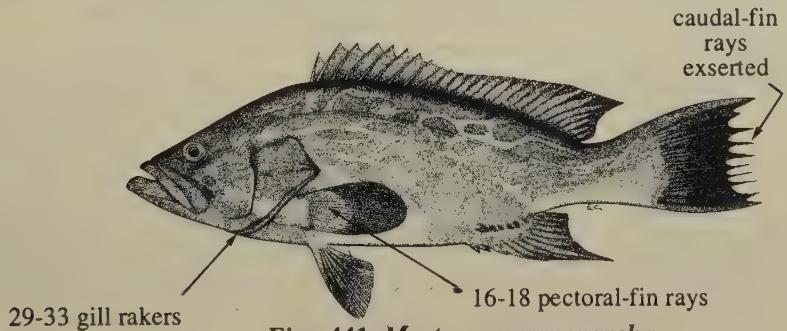

caudal-fin rays exserted
29-33 gill rakers
16-18 pectoral-fin rays

Fig. 441 *Mycteroperca xenarcha*

4a. Gill rakers 37 to 43; rear margin of caudal fin entire (Fig. 442, Plate XXVIII) (Baja California, Gulf of California to Jalisco, Mexico) . . . . *M. rosacea*

4b. Gill rakers 34 to 38; rear margin of caudal fin of fish larger than 40 cm standard length jagged (with exserted rays) (Fig. 443, Plate XXVII) (Gulf of California to Jalisco, Mexico) . . . . *M. prionura*

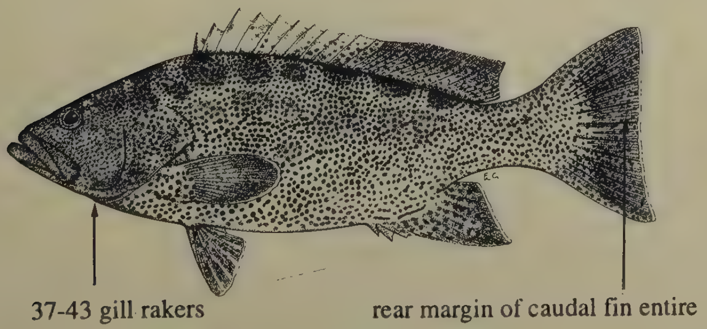

37-43 gill rakers
rear margin of caudal fin entire

Fig. 442 *Mycteroperca rosacea*

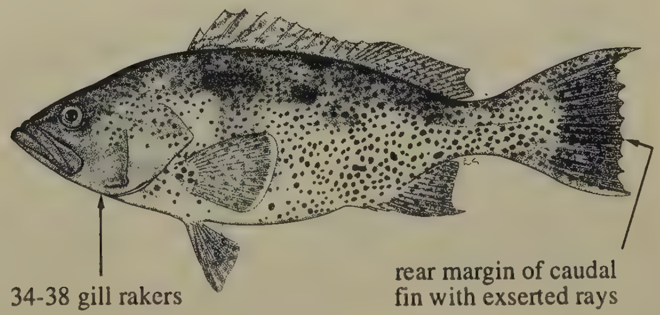

34-38 gill rakers
rear margin of caudal fin with exserted rays

Fig. 443 *Mycteroperca prionura*

Key to the Atlantic species of *Mycteroperca*

1a. Total gill rakers 33 to 55; adults usually uniform dark brown (rarely orange-yellow); juveniles brownish, with white spots and botches and wavy dark lines on head and body . . . . → *2*

1b. Total gill rakers 11 to 41; colour pattern not as in 1a . . . . → *4*

2a. Total gill rakers 48 to 55; maxilla width 4.4 to 5.8% of standard length (for fish 10 to 34 cm standard length) (Fig. 444, Plate XXV) (western Atlantic). . . . . *M. acutirostris*

2b. Total gill rakers 33 to 49; maxilla width 3.6 to 5.0% of standard length (for fish 13 to 55 cm standard length) (eastern Atlantic). . . . . → *3*

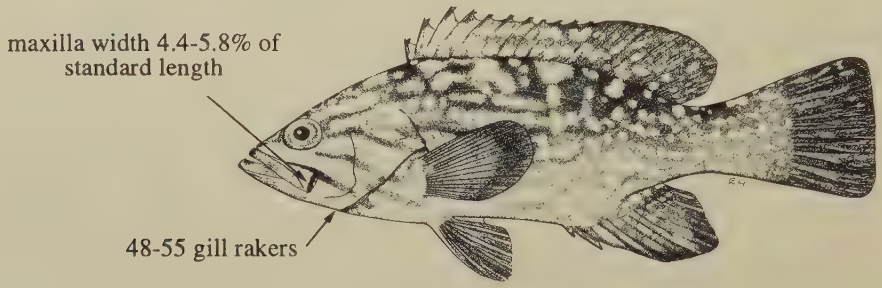

maxilla width 4.4-5.8% of standard length
48-55 gill rakers

Fig. 444 *Mycteroperca acutirostris*

3a. Lower gill rakers 28 to 31 (Fig. 445, Plate XXVIII) (continental shores of eastern Atlantic Ocean, Mediterranean). . . . . *M. rubra*

3b. Lower gill rakers 20 to 24 (Fig. 446, Plate XXVI) (Madeira, Azores, Canary and Cape Verde Islands) . . . . *M. fusca*

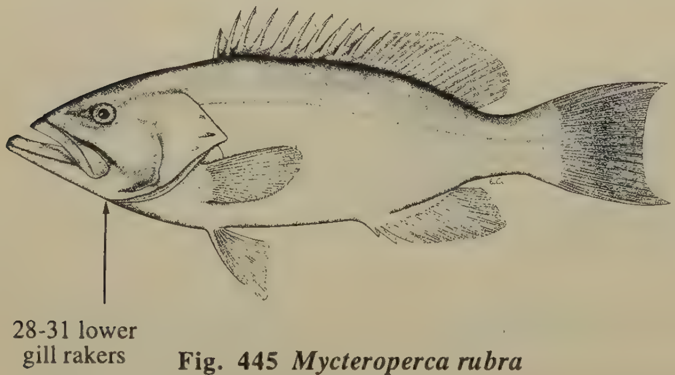

28-31 lower gill rakers

Fig. 445 *Mycteroperca rubra*

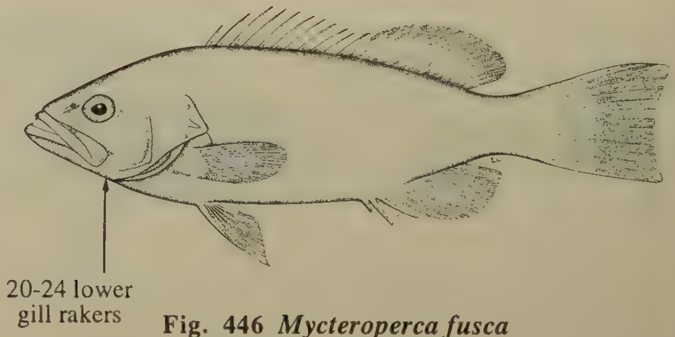

20-24 lower gill rakers

Fig. 446 *Mycteroperca fusca*

4a. Preopercle of fish larger than 25 cm standard length with a distinct notch above the serrate lobe at angle (Fig 447). . . . . → *5*

4b. Preopercle rounded, without a distinct notch or lobe (Fig. 448) . . . . → *8*

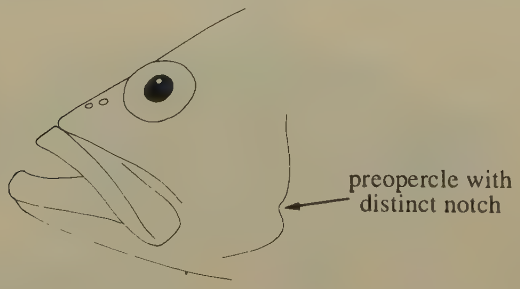

preopercle with distinct notch

Fig. 447

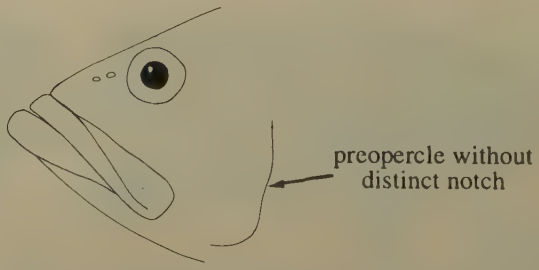

preopercle without distinct notch

Fig. 448

5a. Median fins of adults without exserted rays; head and body brownish or grey, with dark blotches or mottling on sides and dorsally; ventral parts generally pale, but large males often have a dark grey swath from above pelvic fins to underside of caudal peduncle (Fig. 449, Plate XXVII) (Gulf of Mexico and north to North Carolina, southern Brazil) . . . . *M. microlepis*

5b. Some median fin rays produced beyond fin membranes in large adults . . . . → *6*

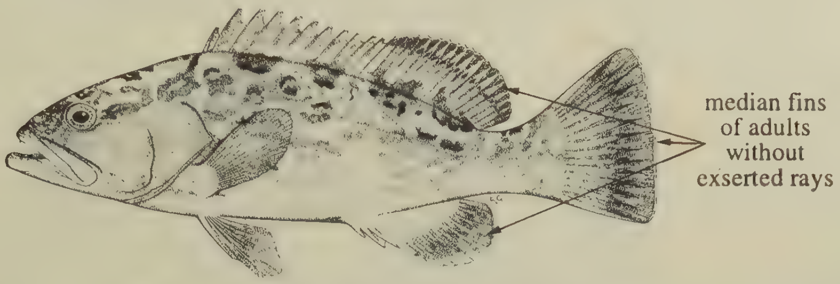

median fins
of adults
without
exserted rays

Fig. 449 ***Mycteroperca microlepis***

6a. Total gill rakers 23 to 27; adults with dorsal half of body almost uniform brown or with small close-set brown spots; pectoral fins dark with white margin; juveniles bicoloured, dark above and light below; mouth and margin of spinous dorsal fin yellow; exserted caudal-fin rays project equally beyond fin membrane (Fig. 450, Plate XXVI) (Gulf of Mexico, Caribbean islands, southern Brazil) . . . . *M. interstitialis*

6b. Total gill rakers 27 to 41; colour not as in 6a; exserted caudal-fin rays (present only in large specimens) uneven . . . . → *7*

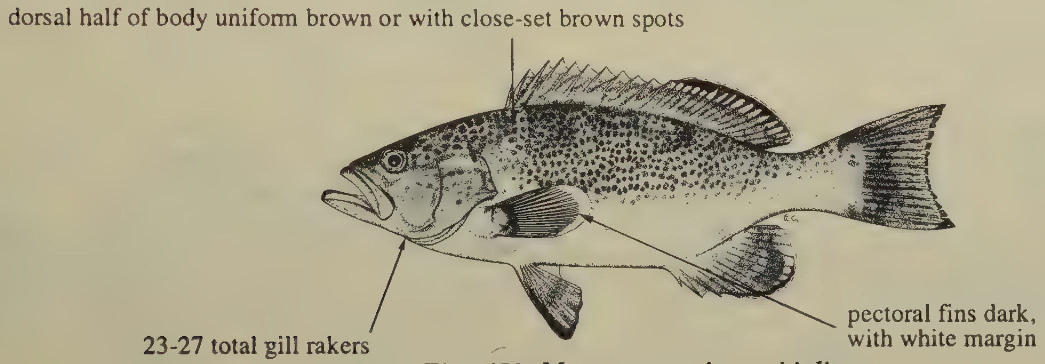

dorsal half of body uniform brown or with close-set brown spots
23-27 total gill rakers
pectoral fins dark,
with white margin

Fig. 450 ***Mycteroperca interstitialis***

7a. Body pale greyish brown, covered (except ventrally) with small, dark reddish brown spots; pectoral-fin membrane clear, the rays dark, the fin margin pale; lower gill rakers 17 to 21 (Fig. 451, Plate XXVII) (eastern and southern coast of USA and along southern coast of Caribbean Sea) . . *M. phenax*

7b. Adults pale brown, with yellowish grey pectoral fins; juveniles greenish brown with irregular brown spots on body; soft dorsal and anal fins with white edge and broad dark submarginal zone; lower gill rakers 21 to 26 (Fig. 452) (Caribbean coast of Venezuela, Jamaica) . . . . . *M. cidi*

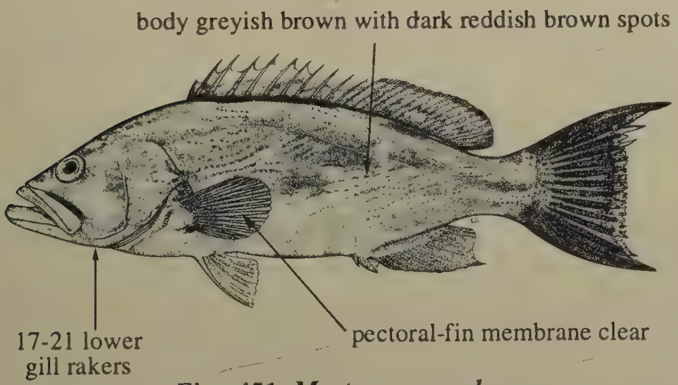

body greyish brown with dark reddish brown spots
17-21 lower
gill rakers
pectoral-fin membrane clear

Fig. 451 ***Mycteroperca phenax***

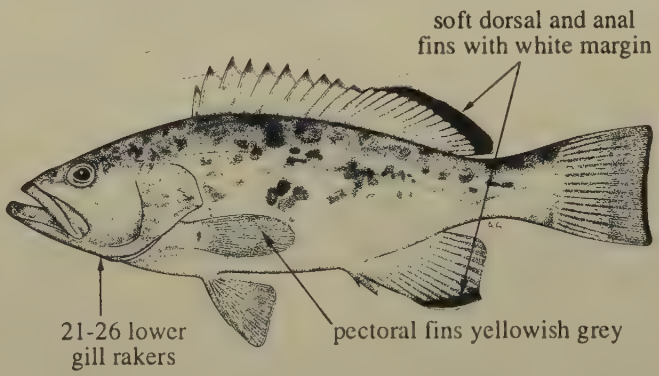

soft dorsal and anal
fins with white margin
21-26 lower
gill rakers
pectoral fins yellowish grey

Fig. 452 ***Mycteroperca cidi***

8a. Developed gill rakers on lower limb 4 to 8; body with 8 or 9 pale oblique lines dorsally, continued below into a pale anastomosing pattern; median-fin rays exserted in adults (Fig. 453, Plate XXVIII) (throughout Caribbean, southern Brazil) . . . . *M. tigris*

8b. Developed gill rakers on lower limb 9 to 16; colour pattern not as in 8a; no exserted fin rays. . . . → *9*

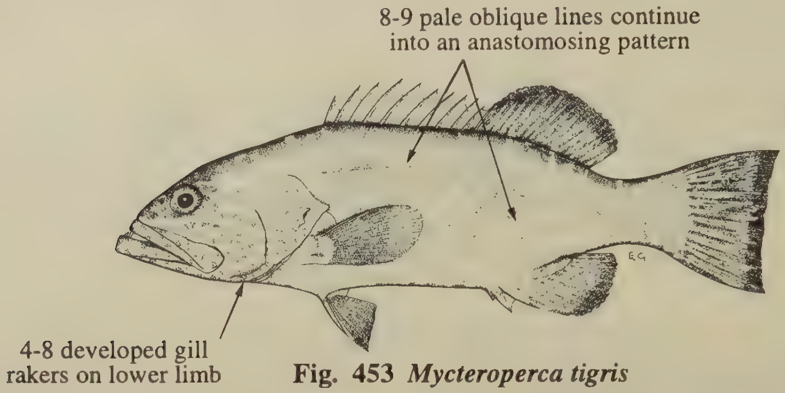

8-9 pale oblique lines continue into an anastomosing pattern
4-8 developed gill rakers on lower limb

Fig. 453 ***Mycteroperca tigris***

9a. Distal third of pectoral fins bright yellow, sharply demarcated from rest of fin; total gill rakers 24 to 27; adults with small red spots on ventral parts of head and body (Fig. 454, Plate XXVIII) (Caribbean, southern Brazil) . . . . *M. venenosa*

9b. Pectoral fins with narrow orange margin that shades gradually into rest of fin; total gill rakers 17 to 24; sides of head and body ventrally with yellowish brown spots separated by a pale blue network (Fig. 455, Plate XXV) (Gulf of Mexico, Caribbean, southern Brazil) . . . . . . *M. bonaci*

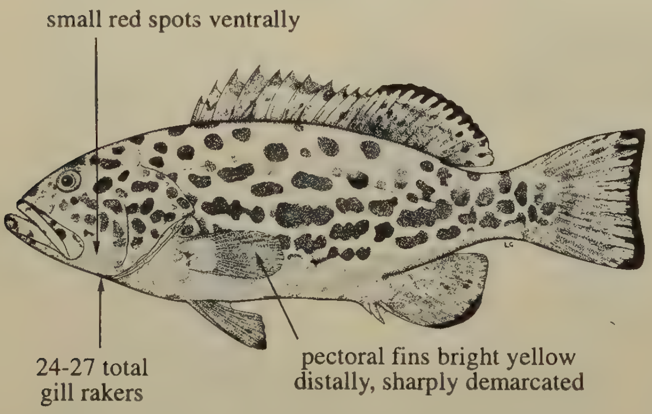

small red spots ventrally
24-27 total gill rakers
pectoral fins bright yellow distally, sharply demarcated

Fig. 454 ***Mycteroperca venenosa***

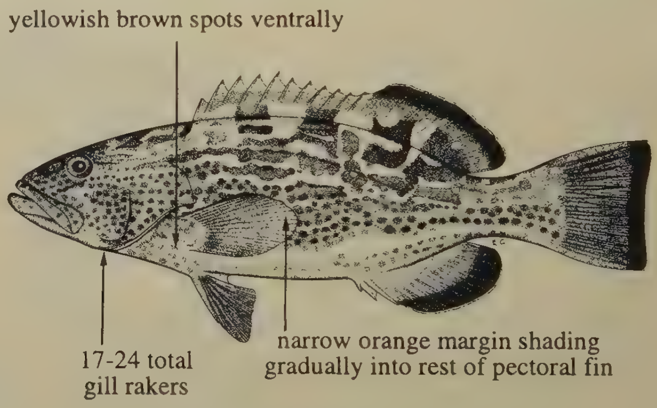

yellowish brown spots ventrally
17-24 total gill rakers
narrow orange margin shading gradually into rest of pectoral fin

Fig. 455 ***Mycteroperca bonaci***

Mycteroperca acutirostris (Valenciennes, 1828)

Fig. 456; Pl. XXVE

SERRAN Myct 14

Serranus acutirostris Valenciennes in Cuv. and Val., 1828:286 (type locality: Brazil).

Synonyms: ***Serranus undulosus*** Valenciennes in Cuv. and Val., 1828:295 (type locality: Brazil). ***Epinephelus chalinius*** Cope, 1871:465 (type locality: St. Martin, West Indies). ***Epinephelus Cuvieri*** Bleeker, 1875:46 (replacement name for ***Serranus undulosus*** Valenciennes, 1828 [thought to be preoccupied in ***Epinephelus*** by ***Bodianus undulosus*** Quoy and Gaimard, 1824]).

FAO Names: **En** - Comb grouper; **Fr** - Badèche peigne; **Sp** - Cuna negra.

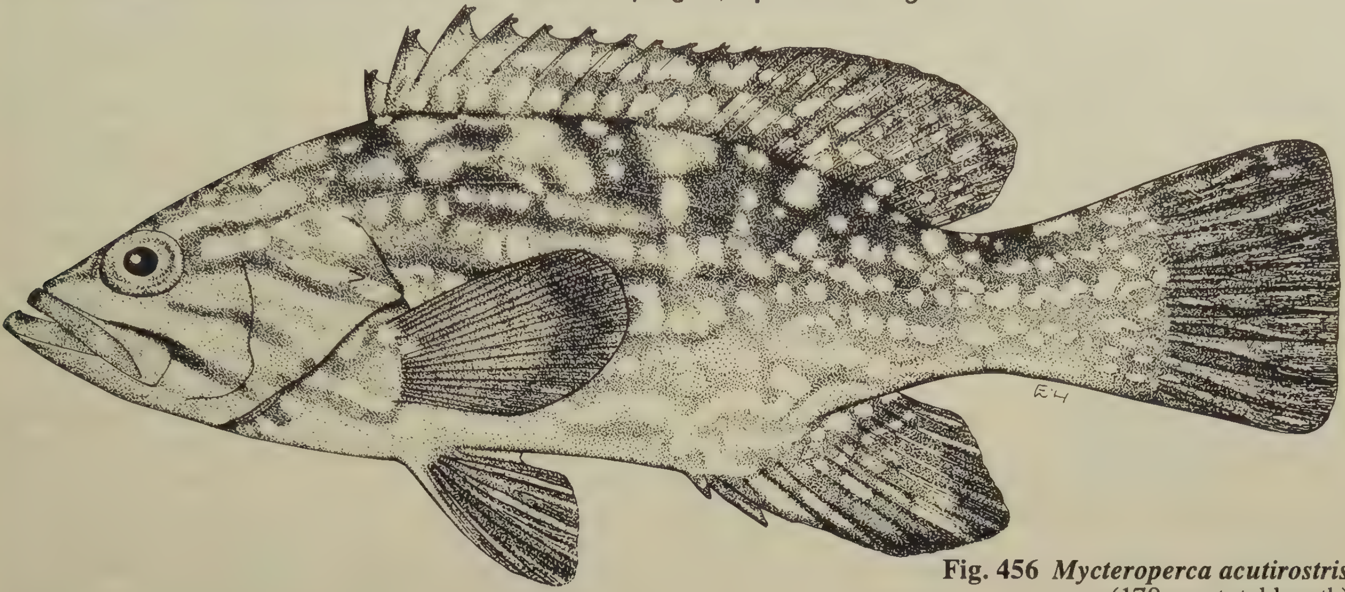


Fig. 456 ***Mycteroperca acutirostris***
(170 mm total length)

Diagnostic Features: Body oblong, compressed, the depth contained 2.7 to 3.2 times in standard length (for 13 fish 10 to 34 cm standard length). Head length contained 2.5 to 2.7 times in standard length; maxilla width 4.4 to 5.8% of standard length; interorbital area convex; preopercle angular, with serrae at the angle enlarged, forming a weak lobe; nostrils subequal. Gill rakers 16 to 20 on upper limb, 32 to 36 on lower limb, total 48 to 55 (mean 51.9, n = 25). Dorsal fin with XI spines and 15 to 17 rays, the interspinous membranes indented, the margin of posterior part of fin rounded; anal fin with III spines and 10 to 12 rays, the fin margin distinctly pointed in adults; pectoral-fin rays 15 to 17; caudal fin rounded in fish less than 10 cm standard length, truncate in fish 12 to 20 cm and concave in fish larger than 25 cm standard length; no exserted caudal-fin rays, although the fin lobes are pointed in large adults. Lateral-line scales 67 to 77; lateral-scale series 85 to 106. **Colour**: Head and body greyish brown, covered with irregular white spots and blotches; 3 or 4 dark brown stripes radiating posteriorly from eye and continuing along ventral half of body as wavy dark stripes; another dark brown stripe continuing backwards from maxillary streak to edge of preopercle; median fins darker than body and also with white spots and streaks; juveniles less than 15 cm with a small black saddle on caudal peduncle; large adults mostly uniform greyish.

Geographical Distribution: Western Atlantic: Bermuda and the northwestern Gulf of Mexico (where it is rare), Cuba, Jamaica, Virgin Islands, Leeward Islands, Panama, Colombia, Venezuela (abundant at Isla Margarita and adjacent islands), Curaçao, and Brazil (common along south coast) (Fig. 457). Valenciennes' (1837:11; 1843:pl. 3, fig. 1) reference to "*Serranus acutirostris*" at the Canary Islands is probably a misidentification of ***M. fusca***.

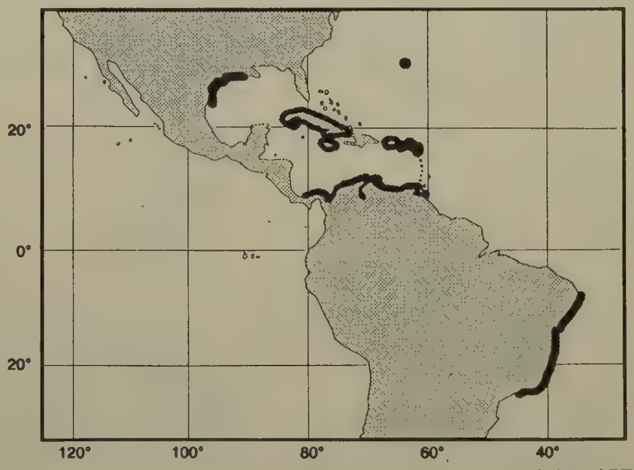


Fig. 457

Habitat and Biology: Juveniles occur in turtle grass beds, mangrove areas, and in shallow water amongst soft corals and coral reefs; adults are found on rocky bottoms with high relief. Probably feeds on plankton, but no information is available on the food of ***M. acutirostris***.

Size: Maximum total length 80 cm; maximum weight probably 4 kg.

Interest to Fisheries: *M. acutirostris* is of considerable commercial importance in the Venezuelan fishery where it is caught mainly with traps.

Local Names: BRAZIL: Badejo-mira; VENEZUELA: Cuna negra.

Literature (references to "*M. rubra*" in the western Atlantic): Cervigón and Velasquez (1966); Cervigón (1966); Randall (1968); Smith (1971). Heemstra (1991) discussed the taxonomy of the *Mycteroperca rubra* species-complex.

Remarks: *Mycteroperca acutirostris* has generally been known as *M. rubra* and thought to be a single species that occurs on both sides of the Atlantic Ocean. Although Smith (1971) synonymized nominal species from the eastern and western Atlantic under the name of *M. rubra* and gave the distribution as both sides of the Atlantic plus the Mediterranean, he did not examine any specimens from the eastern Atlantic. We compared 20 specimens, 10 to 34 cm standard length, of *M. acutirostris* from the western Atlantic with 34 specimens, 6 to 59 cm, from the eastern Atlantic and Mediterranean. These 34 specimens (which are here identified as *M. rubra*) have fewer gill rakers (lower-limb rakers 28 to 31, versus 32 to 36 in *M. acutirostris*) and a narrower maxilla (greatest width 3.8 to 4.5% of standard length, for 14 fish 13 to 45 cm standard length, versus 4.4 to 5.8% of standard length, for 13 *M. acutirostris* of 10 to 34 cm standard length). These differences between *M. rubra* and *M. acutirostris* are relatively minor, and in view of the allopatric distributions of these two taxa, they might be considered as only subspecifically distinct. But the presence of a third distinct population (*M. fusca*) that occurs at the Azores, Madeira, Canaries, and Cape Verde Islands in the Eastern Atlantic implies that each of these populations is genetically distinct from the other two.

Mycteroperca bonaci (Poey, 1860)

Fig. 458; Pl. XXVF

SERRAN Myct 1

Serranus bonaci Poey, 1860:132 (type locality: Cuba).

Synonyms: ***Bonaci arara*** Parra, 1787:30, pl. 16, fig. 2 (type locality: Cuba). ***Serranus arara*** Storer, 1846:279 (after Parra, preoccupied by ***Serranus arara*** Valenciennes, 1828 [= ***Epinephelus guttatus***]). ***Serranus brunneus*** Poey, 1860:131 (type locality: Cuba). ***Serranus decimalis*** Poey, 1860:138 (type locality: Cuba). ***Serranus cyclopomatus*** Poey, 1861:353 (type locality: Cuba). ***Serranus latepictus*** Poey, 1861:353 (type locality: Cuba). ***Trisotropis aguaji*** Poey, 1867:229 (type locality: Cuba). ***Mycteroperca bonaci*** variety ***xanthosticta*** Jordan and Swain, 1885:371 (type locality: Pensacola, Florida).

FAO Names: En - Black grouper; **Fr** - Badèche bonaci; **Sp** - Cuna bonací.

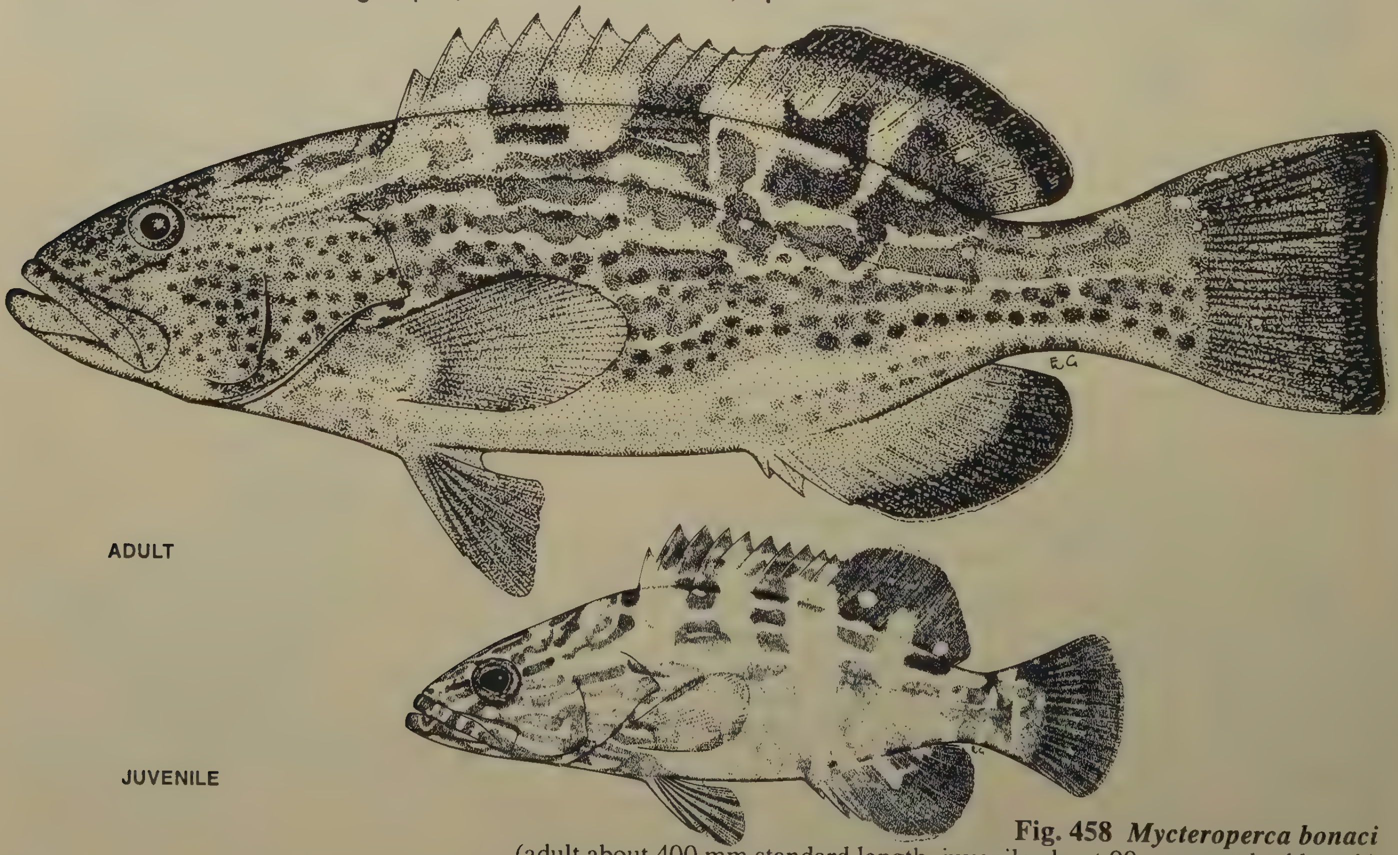


Fig. 458 ***Mycteroperca bonaci***
(adult about 400 mm standard length, juvenile about 90 mm standard length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 3.3 to 3.5 times in standard length (for fish 15 to 59 cm standard length). Head length contained 2.5 to 2.8 times in standard length; preopercle evenly rounded, without a distinct notch or lobe at the angle; nostrils subequal. Developed gill rakers 2 to 5 on upper limb, 8 to 12 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the interspinous membranes distinctly incised; anal fin with III spines and 11 to 13 rays; pectoral-fin rays 16 or 17; no median fin rays exserted; margins of dorsal and anal fins rounded; caudal fin truncate (convex if widely spread) to slightly emarginate. Lateral-line scales 78 to 83; lateral-scale series 119 to 126. **Colour**: Head and body greyish or dark brown, with close-set, irregular, bronze, or brassy spots separated by a bluish reticulum (some brassy spots join to form chain-like horizontal streaks); dorsolateral part of body sometimes with 7 or 8 columns of rectangular dark blotches, the first above opercle and the last on caudal peduncle. Pectoral fins dusky brown, gradually becoming orange at the margin; soft dorsal and anal fins and leading edge of pelvic fins with dark margin.

Geographic Distribution: Western Atlantic from Bermuda and Massachusetts to southern Brazil, including the southern Gulf of Mexico, Florida Keys, Bahamas, Cuba, and throughout the Caribbean (Fig. 459). Adults are not known from the northeastern coast of the USA.

Habitat and Biology: *M. bonaci* is found on rocky bottoms and coral reefs in depths of 10 to 30 m; but in the eastern Gulf of Mexico, Bullock and Smith (1991) state that it "is usually found at depths of 30 m or greater ..." Adults feed primarily on fishes, and juveniles prey mainly on crustaceans. Smith (1959) presented evidence for protogynous hermaphroditism in this species. Bullock and Smith (1991) reported ripe females of 50 to 100 cm and ripe males 96 to 116 cm from the Gulf of Mexico. Specimens in spawning condition were caught on the Campeche Bank in July and August (Smith, 1961). The egg count of 5 035 240 reported by Smith (1961) for an 805 mm standard length fish with an ovary weight of 587.2 g is off by a factor of 10; the correct egg count calculated from his 0.8 g sample of ovary tissue which contained 686 eggs would be 503 524 eggs. The fecundity counts of the other three species in Smith's (1971) paper are also erroneous.

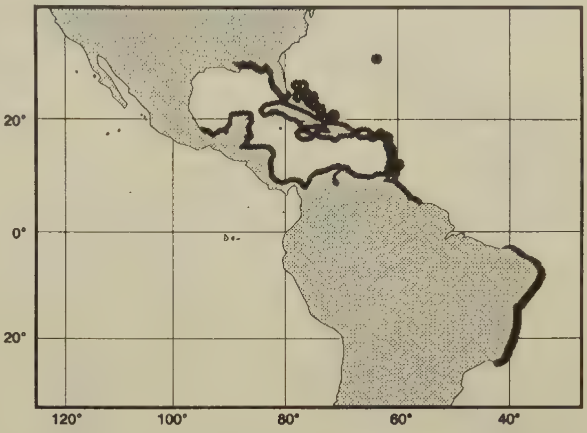


Fig. 459

The weight-length relationship and von Bertalanffy growth equation given by Manooch and Mason (1987) are as follows:

$W = 5.548 \times 10^{-6} L^{3.141}$, where W is weight in grammes and L is total length in millimetres.

$L_t = 1{,}325(1 - e^{-0.1156(t+0.927)})$, where L_t is total length in mm at age t.

The weight-length relationship for 46 *M. bonaci* from the eastern Gulf of Mexico was given by Bullock and Smith (1991) as follows:

$W = 3.42 \times 10^{-9}\ TL^{3.210} (r^2 = 0.99)$, where W is whole weight in kilogrammes and TL (total length) is in millimetres.

Size: Attains at least 133 cm total length and a weight of 65 kg. Mowbray (1950) reported that *M. bonaci* at Bermuda attain a weight of 81 kg.

Interest to Fisheries: *M. bonaci* is one of the most important species in the fishery at Bermuda and also in the fisheries of the southern Gulf of Mexico, Cuba, and the east coast of Venezuela.

Local Names: BERMUDA: Rockfish; BRAZIL: Badejo-quadrado; CUBA: Bonaci; VENEZUELA: Cuna guarei.

Literature: Cervigón and Velasquez (1966); Smith (1971); Randall (1967); Thompson and Munro (1983); Manooch and Mason (1987).

Remarks: Adults of *M. cidi*, *M. interstitialis*, *M. microlepis*, and *M. phenax* differ from *M. bonaci* in having a projecting bony lobe at the corner of the preopercle; adults of *M. cidi*, *M. interstitialis*, and *M. phenax* also have exserted caudal-fin rays; *M. microlepis* has more lateral-line scales (88 to 96) and usually fewer (10 to 12) anal-fin rays. *M. tigris* differs in having fewer gill rakers (4 to 8 developed rakers on lower limb), interobital area flat, adults with exserted caudal-fin rays, and rear nostrils 3 to 5 times larger than anterior nostrils. *M. venenosa* differs in having the rear nostrils of adults distinctly larger than the anterior nostrils, the dorsolateral parts of head and body with oblong dark blotches scattered over groups of small black spots, the ventral parts with small dark red spots, and the distal third of pectoral fins abruptly yellow.

Mycteroperca cidi Cervigón, 1966

Fig. 460

SERRAN Myct 2

Mycteroperca cidi Cervigón, 1966:300, fig. 117 (type locality: Isla Cubagua, Venezuela).

Synonyms: ?*Labrus gvaza* Linnaeus, 1758:285 (type locality: "in pelago"; based on *Labrus guaza* Loefling, 1758:104 (type locality: Cumana, Venezuela; see "Remarks" for *Epinephelus marginatus* of this catalogue).

FAO Names: **En** - Venezuelan grouper; **Fr** - Badèche blanche; **Sp** - Cuna blanca.

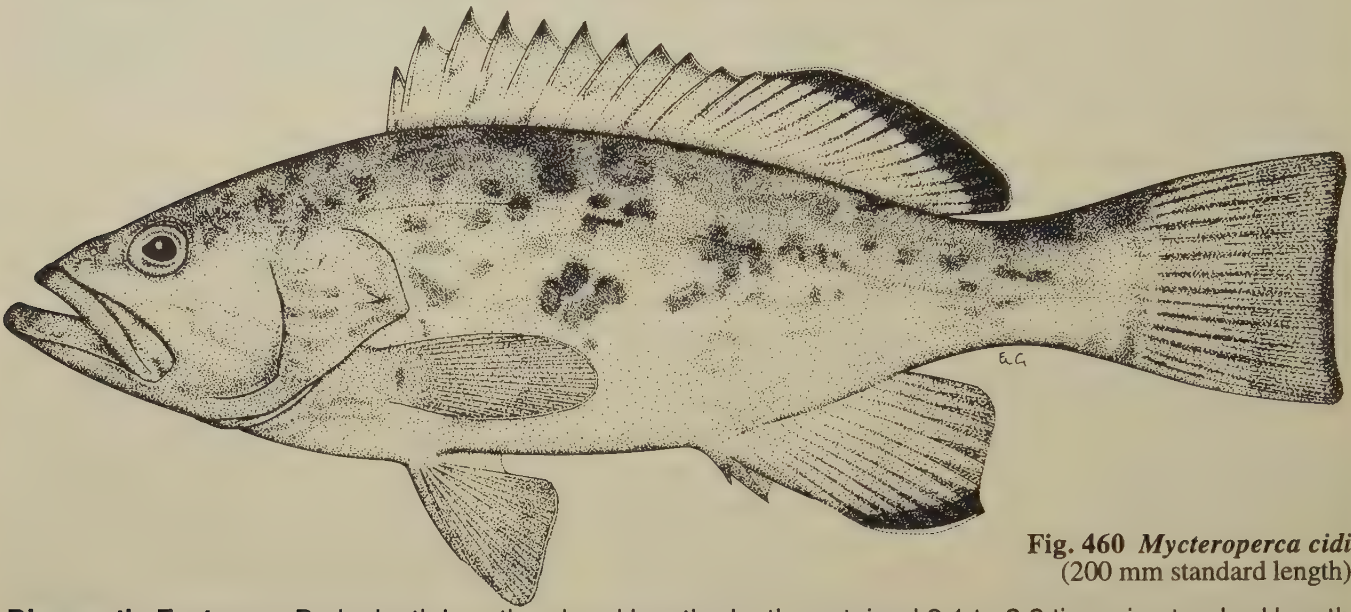


Fig. 460 *Mycteroperca cidi* (200 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 3.1 to 3.3 times in standard length (for fish 14 to 93 cm standard length). Interorbital area distinctly convex; preopercle angular, with a distinct lobe bearing enlarged serrae at the angle; nostrils subequal in fish less than 25 cm, but in fish larger than 40 cm the posterior nostrils are much larger than the anteriors. Gill rakers well developed, the longest is longer than eye diameter; 9 to 13 on upper limb, 18 to 23 on lower limb (not counting 2 to 4 rudiments on each limb). Dorsal fin with XI spines and 15 to 17 rays, the 9th to 11th rays distinctly longer than the others in adults, giving the fin an angular aspect; anal fin with III spines and 10 to 12 rays, the fin margin pointed in adults with fourth to sixth rays elongated; pectoral-fin rays 15 to 17; caudal fin truncate to slightly emarginate, with greatly exserted rays in adults (greater than 40 cm total length). Lateral-body scales smooth; lateral-line scales about 75; lateral-scale series 108 to 126. **Colour**: Adults pale greyish brown; juveniles greenish brown with irregular brown spots on body; soft dorsal and anal fins with white edge and dark submarginal band.

Geographical Distribution: Caribbean coast of Venezuela (Fig. 461). Three specimens were reported from the Port Royal reefs off Jamaica (Thompson and Munro, 1983) indicating that this recently described species may be found at other Caribbean localities.

Habitat and Biology: *M. cidi* is common on coral reefs in depths of 5 to 8 m; large adults are caught in 20 to 40 m; juveniles are found in shallow water over sandy bottom near coral reefs and seagrass beds.

Size: Maximum total length 109 cm; maximum weight 14.5 kg.

Interest to Fisheries: An important species in the fisheries off the Caribbean coast of Venezuela where it is one of the three most abundant groupers in shallow water. Caught with traps and hook-and-line. Marketed fresh.

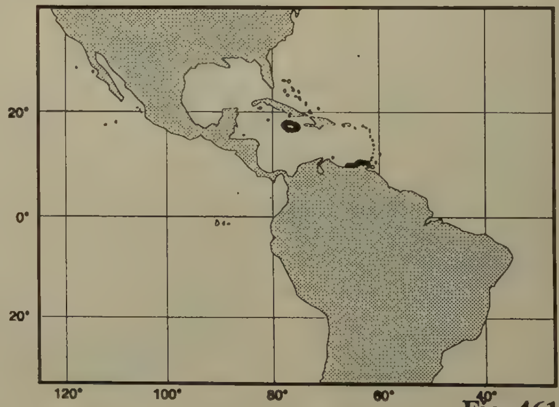


Fig. 461

Local Names: VENEZUELA: Cuna rabo rajao.

Literature: Cervigón and Velasquez (1966).

Remarks: *M. intersitialis* differs from *M. cidi* in colour pattern and in having fewer gill rakers 4 to 6 on upper limb, 11 to 15 on lower limb (not counting rudiments). *M. phenax* differs from *M. cidi* in having the body covered (except ventrally) with close-set, small dark spots which extend onto the median fins and in having the lateral-body scales ctenoid.

Mycteroperca fusca (Lowe, 1836)

Fig. 462; Pl. XXVIA-C

SERRAN Myct 15

Serranus fuscus Lowe, 1836:196 (type locality: Madeira).

Synonyms: ?*Serranus emarginatus* Valenciennes, 1843:10 (type locality: Canary Islands). *Serranus simonyi* Steindachner, 1891:352, pl. 1, fig. 1 (type locality: Grand Canary Island).

FAO Names: **En** - Island grouper; **Fr** - Merou d'île; **Sp** - Abadejo.

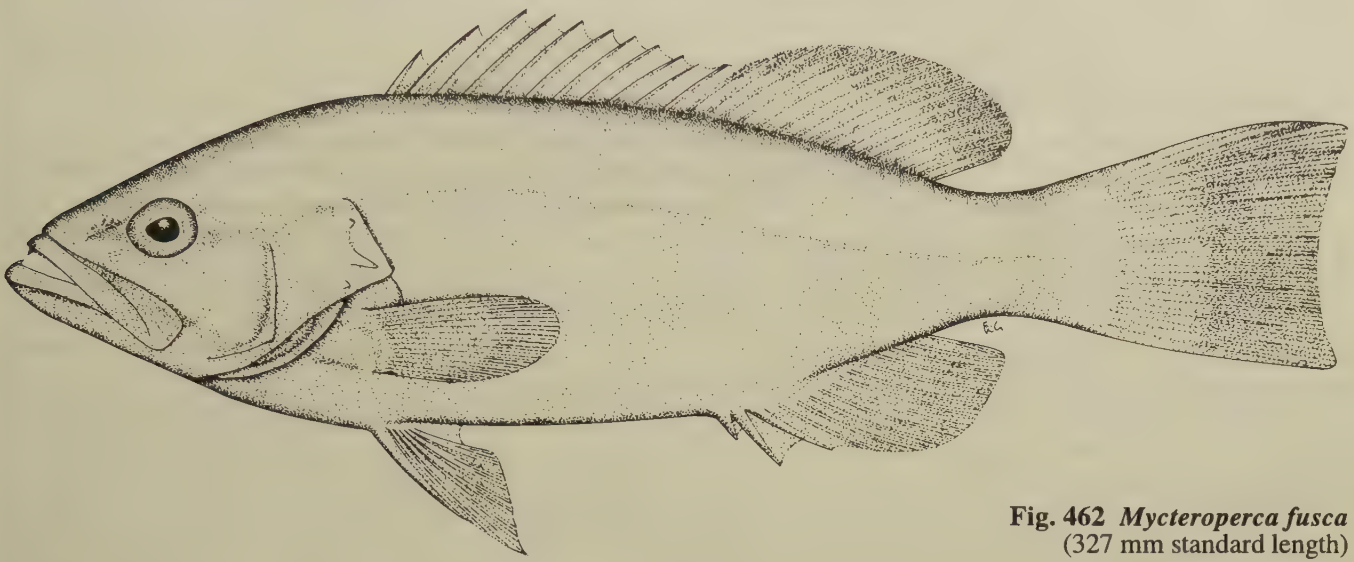


Fig. 462 *Mycteroperca fusca*
(327 mm standard length)

Diagnostic Features: Body oblong, compressed, the depth less than head length, depth contained 3.0 to 3.3 times in standard length (for fish 15 to 51 cm standard length). Head length contained 2.6 to 2.9 times in standard length; interorbital area convex; preopercle serrae enlarged at angle, forming a rounded lobe below a shallow indentation on vertical limb; subopercle and interopercle with a few small serrae; nostrils subequal in juveniles, the diameter of rear ones about 3 times larger than front nostrils in fish larger than 45 cm standard length; maxilla width 3.8 to 5.0% of standard length; lower jaw extends well in front of upper jaw. Gill rakers 11 to 14 on upper limb, 20 to 24 on lower limb, total 32 to 36, Dorsal fin with XI spines and 14 to 16 rays, the interspinous membranes distinctly indented, the margin of soft-rayed part rounded; anal fin with III spines and 10 to 12 rays, the fin margin rounded; pectoral-fin rays 15 to 17; caudal-fin rear margin truncate (juveniles) to concave (adults). Lateral-line scales 72 to 78; lateral-scale series 96 to 106. **Colour**: At Madeira, most adults are brownish or dark grey, with irregular pale blotches and spots and a prominent maxillary streak; a live fish under stress may reverse this pattern so that the head and body are pale, with irregular dark markings. A 143 mm standard length juvenile caught in a tidepool was mottled greenish brown, with prominent white spots on the head and body, white streaks on the median fins and hyaline golden pectoral fins. *M. fusca* that are uniformly golden are occasionally caught at Madeira, and one such xanthic fish was caught in December 1988 and put in an aquarium at the Municipal Museum of Funchal. Manuel Biscoito photographed this fish when it was first put in the aquarium and observed it change, within a few weeks, to the normal brown colour.

Geographical Distribution: *Mycteroperca fusca* is known with certainty only from Madeira, the Azores, and the Canary and Cape Verde Islands (Fig. 463).

Habitat and Biology: Like most groupers, *M. fusca* occurs near the bottom in rocky areas. At the Azores it was observed by the senior author at depths of 20 to 30 m. Juveniles are found in tidepools. Two specimens from the Cape Verde Islands were collected by J. Cadenat from a depth of "50 m."

Size: Attains at least 80 cm total length and a weight of 3 kg.

Interest to Fisheries: *M. fusca* is a common species in the markets at Madeira.

Local Names: PORTUGAL: Badejo (Azores and Madeira); SPAIN (Canary Islands): Abade, Abae, Sama.

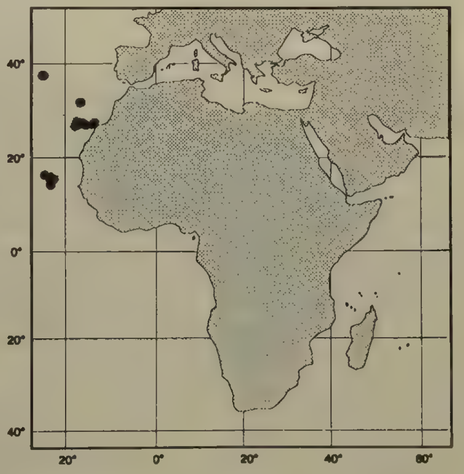


Fig. 463

Literature: Heemstra (1991) recognized ***M. fusca*** as a valid species and discussed the taxonomy of this species. In their checklist of the shorefishes of the Canary Islands, Dooley et al. (1985) included the paper in which Steindachner described ***M. simonyi*** in their list of cited literature, but they omitted ***Serranus simonyi*** in their text. They list ***Mycteroperca rubra*** (with Valenciennes' descriptions of ***Serranus fuscus***, ***S. acutirostris***, and ***S. emarginatus*** as synonyms) as the only species of ***Mycteroperca*** at the Canary Islands. It is possible that both ***M. rubra*** and ***M. fusca*** occur there, but there is no evidence for the presence of ***M. rubra*** in the Canaries.

Waschkewitz and Wirtz (1990) reported on the annual migration and return to the same site in Madeira of a xanthic grouper identified as ***Epinephelus alexandrinus***. This fish is probably ***M. fusca***, because 1) "***Epinephelus alexandrinus***" (= ***E. costae***) does not occur in Madeira; 2) in a recent book on the marine fauna of Portugal, Madeira and the Azores (Saldanha, 1979) a photograph of ***M. fusca*** was misidentified as ***Epinephelus alexandrinus***; and 3) xanthic specimens of ***M. fusca*** are known at Madeira and the Canary Islands.

Remarks: All 13 specimens of ***Mycteroperca*** that Heemstra (1991) examined from Madeira have the typical low gill-raker counts (11 to 14 on upper limb and 20 to 23 on lower limb) for this species. It appears, therefore, that ***M. rubra*** (with gill-raker counts of 16 to 18 on upper limb and 28 to 32 on lower limb) does not occur at Madeira. Although Lowe's (1836) original description of ***Serranus fuscus*** clearly applies to a species of ***Mycteroperca***, he did not give gill-raker counts for his specimen; and this holotype is apparently not extant. Heemstra (1991) redescribed ***M. fusca*** and designated a neotype for ***Serranus fuscus*** Lowe.

Serranus simonyi, described by Steindachner (1891) from two specimens collected at the Canary Islands, was included in the synonymy of ***Mycteroperca rubra*** by Boulenger (1895) and Fowler (1936), but it was overlooked by C.L. Smith (1971). The smaller of the two syntypes in the Naturhistorisches Museum of Vienna (NMW 39457, 314 mm standard length) has a misshapen anal fin (as is evident in Steindachner's original illustration) with only 7 soft anal-fin rays, but the 336 mm standard length syntype has a normal anal fin with 12 soft rays. And the dorsal-fin count of XI spines and 16 rays (XI spines,15 rays in the illustrated specimen) also matches the dorsal-fin counts for ***M. rubra***. However, the gill-raker count of 12 on upper limb and 23 on lower limb given by Steindachner (and confirmed on both syntypes by Dr Barbara Herzig) is considerably fewer than counts for ***M. rubra***. In view of this significant difference in the number of gill rakers, we recognize ***M. simonyi*** as a synonym of ***M. fusca***.

Mycteroperca interstitialis (Poey, 1860) Fig. 464; Pl. XXVID-F SERRAN Myct 3

Serranus interstitialis Poey, 1860:127 (type locality: Cuba).

Synonyms: ?***Labrus gvaza*** Linnaeus, 1758:285 (type locality: "in pelago"; based on ***Labrus guaza*** Loefling, 1758:104 (type locality: Cumana, Venezuela; see "Remarks" for ***Epinephelus marginatus*** in this catalogue). ***Serranus dimidiatus*** Poey, 1860:129 (type locality: Cuba). ***Serranus falcatus*** Poey, 1860:138 (type locality: Cuba). ***Mycteroperca calliura*** Poey, 1865:181 (type locality: Cuba). ***Trisotropis chlorostomus*** Poey, 1867:231 (type locality: Cuba). ***Mycteroperca roquensis*** Martin, 1956:100 (type locality: Gran Roque Island, Venezuela).

FAO Names: **En** - Yellowmouth grouper; **Fr** - Badèche gueule jaune; **Sp** - Cuna amarilla.

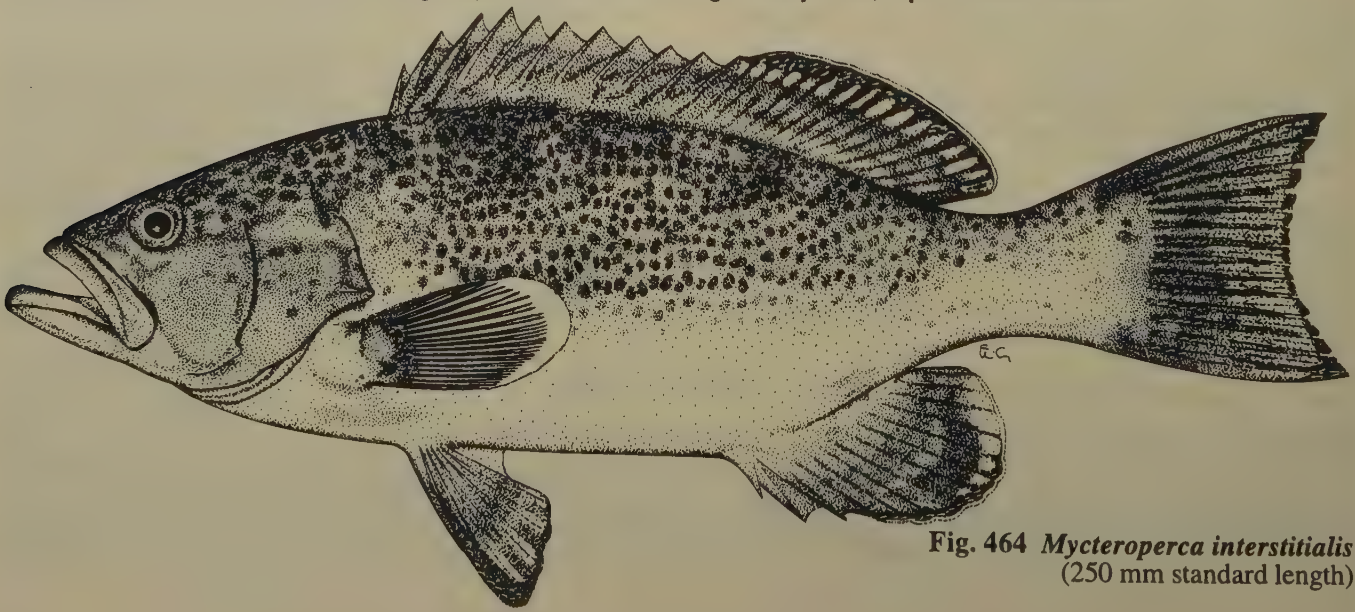


Fig. 464 ***Mycteroperca interstitialis***
(250 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 3.0 to 3.4 times in standard length (for fish 22 to 65 cm standard length). Head length contained 2.8 to 3.0 times in standard length; preopercle angular, with a prominent lobe bearing enlarged serrae at the angle and a distinct notch above the serrate lobe; posterior nostrils greatly enlarged in adults. Gill rakers 4 to 6 on upper limb, 11 to 15 on lower limb, plus 3 to 5 rudiments on each limb, total 23 to 27. Dorsal fin with XI spines and 16 to 18 rays, the 12th and 13th rays elongated in adults, giving the fin a pointed rear margin; anal fin with III spines and 10 to 12 rays, the fin margin pointed in adults, with sixth to eighth rays distinctly longer than others; pectoral-fin rays 16 or 17; caudal fin emarginate, with evenly exserted rays in adults. Lateral-body scales ctenoid (weakly so in large adults); lateral-line scales 70 to 74; lateral-scale series 112 to 128. **Colour**: Pale brownish grey, with close-set small brown spots on dorsal part of body; margin of spinous dorsal fin and mouth yellowish; pectoral-fin membranes clear, the rays dark and the fin margin with a white edge; dark moustache streak present above maxilla. Some specimens are uniform brown dorsally, and others may have faint, irregular vertical bars. Juveniles bicoloured: head and body dark brown dorsally (the dark dorsal colour may be broken into broad dark bars or saddle blotches) and abruptly white below; a white middorsal stripe from tip of lower jaw along top of snout, head, and base of dorsal fin.

Geographical Distribution: Western Atlantic Ocean: Gulf of Mexico, Bermuda, Caribbean (mainly insular localities), and southern Brazil (Fig. 465).

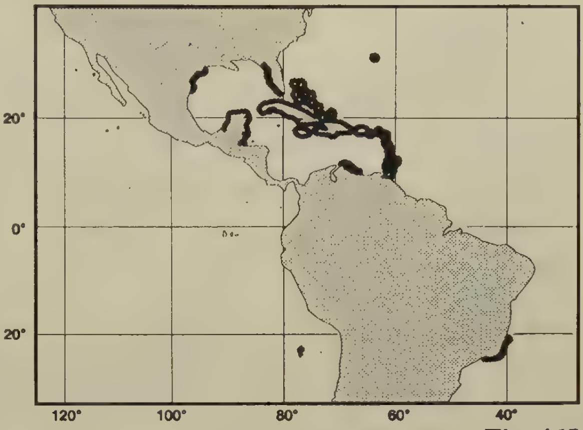


Fig. 465

Habitat and Biology: *M. interstitialis* occurs on coral reefs and rocky bottom in depths of 20 to 150 m. Dennis and Bright (1988) found that it was common (along with its continental "replacement," *M. phenax*) on the algal-sponge zone of the Flower Garden Banks in the northwestern Gulf of Mexico. Spawning in Bermuda occurs from June to August (Smith, 1971); in Jamaican waters, ripe fish were found in April (Thompson and Munro, 1983). On the Florida Middle Grounds, Bullock and Smith (1991) reported ripe fish in December, March to July and September, and spent females were found in August and September; ovulated oocytes measured 0.80 to 1.20 mm in diameter. Randall (1967) reported that all 5 of the *M. interstitialis* that he found with food in their stomachs contained only fishes, and Bullock and Smith (1991) also found a variety of fishes in the stomachs of specimens from the Gulf of Mexico.

The weight-length relationship for 97 *M. interstitialis* from the Gulf of Mexico was given by Bullock and Smith (1991) as follows: $W = 4.7 \times 10^{-8} SL^{2.893}$ ($r^2 = 0.95$), where W is the whole weight in kilogrammes and SL (standard length) is in millimetres.

Size: Maximum total length 74 cm, maximum weight 7 kg.

Interest to Fisheries: Although separate statistics are not published for *M. interstitialis*, it is an important species in the fishery of Bermuda, the Gulf of Mexico, and throughout the Caribbean. Caught with hook-and-line, traps, and spear. According to Nagelkerken (1981) the population in Curação decreased sharply as a result of intensive spearfishing.

Local Names: CUBA: Abadejo; VENEZUELA: Cuna chulinga, Cuna raba rajao.

Literature: Cervigón and Valasquez (1966); Randall (1967, 1968); Smith (1971); Thompson and Munro (1983); Bullock and Smith (1991).

Remarks: *M. interstitialis* is very similar to *M. phenax*; both species have a projecting lobe at the corner of the preopercle, similar colour pattern, and fin counts, and adults with enlarged posterior nostrils and exserted median fin rays. *M. interstitialis* of 20 to 57 cm standard length usually has shorter pelvic fins and a shorter head (15 to 17% and 30 to 36% of standard length, versus 18 to 20% and 36 to 38% of standard length respectively in *M. phenax*); *M. interstitialis* also lacks dark spots on the dorsal and anal fins, and the exserted caudal-fin rays are of similar length; whereas *M. phenax* has small brown spots on these fins and the exserted caudal-fin rays are more uneven. Juveniles of *M. interstitialis* are distinctly bachelorhood, but juveniles of *M. phenax* are coloured much the same as adults. Contrary tc C.L. Smith's (1971:194) statement, the body depth of *M. interstitialis* is not greater than that of other species of *Mycteroperca*.

M. cidi differs from *M. interstitialis* in colour pattern and in more gill rakers (9 to 13 on upper limb, 18 to 23 on lower limb, plus 2 to 4 rudiments on each limb).

Mycteroperca jordani (Jenkins and Evermann, 1889) Fig. 466; Pl. XXVIIA-C **SERRAN Myct 9**

Epinephelus jordani Jenkins and Evermann, 1889:140 (type locality: Guaymas, Sonora, Mexico).

Synonyms: ***Mycteroperca venadorum*** Jordan and Starks, in Jordan, 1895:446 (type locality: Isla Blanca, off Sinaloa, Mexico).

FAO Names: **En** - Gulf grouper; **Fr** - Mérou golfe; **Sp** - Mero baya.

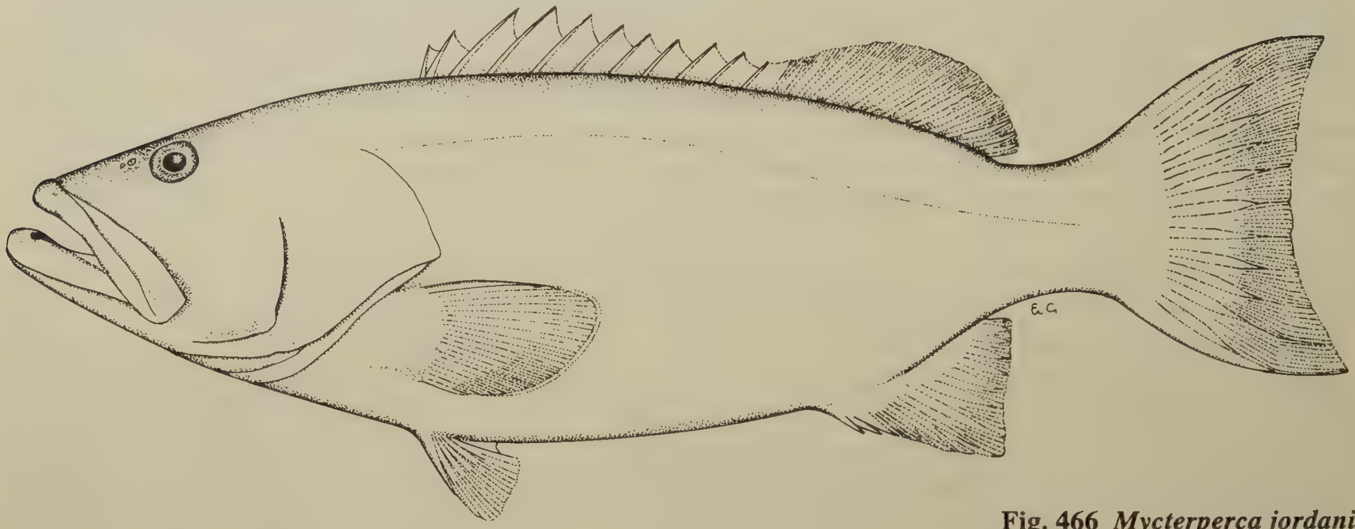


Fig. 466 ***Mycterperca jordani***
(1500 mm standard length)

Diagnostic Features: Body depth much less than head length, depth contained 3.1 to 3.4 times in standard length (for fish 23 to 51 cm standard length). Head length contained 2.5 to 2.7 times in standard length; preopercle rounded, finely serrate, without a distinct lobe at the angle; posterior nostrils not notably enlarged, their diameter less than twice that of anterior nostrils. Total gill rakers 21 to 26, not counting rudiments. Dorsal fin with XI spines (fourth or fifth longest) and 16 or 17 rays, the interspinous membranes deeply incised in adults; posterior margin of dorsal fin rounded; anal fin with III spines and 10 or 11 rays, the fin margin pointed in large adults; pectoral-fin rays 16 to 18; no fin rays exserted; caudal fin rounded in juveniles, truncate to emarginate in adult. Midlateral-body scales ctenoid on small juveniles, smooth on adults; lateral-line scales 75 to 85; lateral-scale series 125 to 128. **Colour**: Adults usually uniform dark brown or grey, but they can rapidly assume the juvenile pattern if disturbed or excited. In large adults, the pectoral-fin margin is white and the median fins have a narrow white edge. Juveniles greyish brown, with large, dark grey oblong blotches on dorsal part of body and fins.

Geographical Distribution: Eastern Pacific from La Jolla, California to Mazatlan, Mexico (Fig. 467).

Habitat and Biology: Rocky reefs and kelp beds in depths of 5 to 30 m. Little has been published on the biology of this large species. Rosenblatt and Zahuranec (1967) found fish remains in the stomach of a large adult, and Thompson et al. (1979) report juvenile hammerhead sharks as prey of large *M. jordani*. Juveniles are unknown in California waters, and the few large adults that have been taken there are probably expatriates from a more southerly breeding population (Rosenblatt and Zahuranec, 1967).

Size: Maximum total length 150 cm; maximum weight 91 kg.

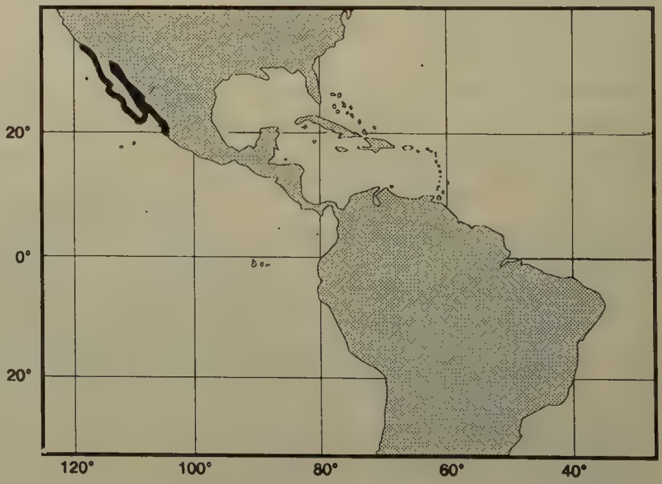


Fig. 467

Interest to Fisheries: Because of its large size, this species is sought by anglers and spearfishermen.

Local Names: MEXICO: Cabrilla de astillero, Garlopa.

Literature: Walford (1937); Rosenblatt and Zahuranec (1967); Smith (1971); Thomson et al. (1979).

Remarks: *M. prionura* and *M. xenarcha* differ from *M. jordani* in colour pattern and in having more gill rakers (34 to 38 and 29 to 33 total, not counting rudiments), 15 or 16 pectoral-fin rays, and adults with a projecting serrate lobe at the angle of the preopercle and exserted caudal-fin rays. *M. rosacea* also has more gill rakers (38 to 43 total, not counting rudiments).

Mycteroperca microlepis (Goode and Bean, 1880)

Fig. 468; Pl. XXVIIA-C

SERRAN Myct 4

Trisotropis microlepis Goode and Bean, 1880:141 (type locality: west Florida).

Synonyms: *Trisotropis stomias* (in part) Goode and Bean, 1883:427 (type locality restricted to Florida by lectotype designation of C.L. Smith, 1971:189).

FAO Names: **En** - Gag; **Fr** - Badèche baillou; **Sp** - Cuna aguají.

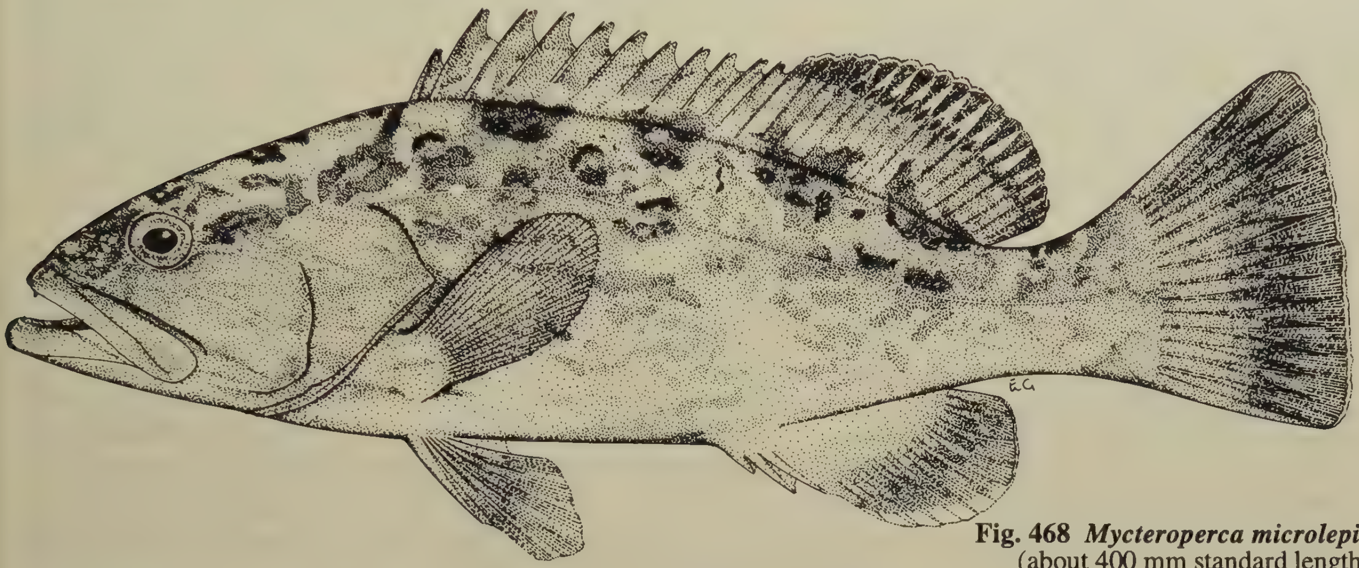


Fig. 468 ***Mycteroperca microlepis***
(about 400 mm standard length)

Diagnostic Features: Body depth much less than head length, depth contained 3.0 to 3.5 times in standard length (for fish 12 to 42 cm standard length). Head length contained 2.5 to 2.7 times in standard length; interorbital area convex; corner of preopercle (on fish larger than about 40 cm standard length) produced into a rounded lobe bearing enlarged serrae; adults (larger than 60 cm) with posterior nostrils much larger than anterior ones. Gill rakers 8 or 9 on upper limb, 16 on lower limb, including 5 or 6 rudiments on each limb. Dorsal fin with XI spines and 16 to 18 rays, the third or fourth spine longest and the membranes distinctly incised between the spines; anal fin with III spines and 10 to 12 rays; dorsal and anal fins rounded at all sizes; no exserted dorsal- and anal-fin rays; pectoral-fin rays 16 to 18; caudal fin emarginate. Lateral-body scales smooth, except those covered by pectoral fin; lateral-line scales 88 to 96; lateral-scale series 128 to 146. **Colour**: Adult females and juveniles are generally brownish grey with darker vermiculations; a resting or "camouflage phase" shows 5 dark brown saddles separated by short white bars below the dorsal fin; this pattern is characteristic of fish that are sitting on the bottom. Unlike the camouflage phase, the "black-belly" and "black-back" phases are not ephemeral and are displayed only by large adults (males). The black-belly phase is mostly pale grey, with faint dark reticulations below the soft dorsal fin; the belly and ventral part of the body above the anal fin are black, as are the margin of the soft dorsal fin, central rear part of caudal fin and rear margins of pectoral and pelvic fins. The black-back phase is similar to the black-belly phase, but with more black pigment on rear part of body, dorsal half of peduncle, all of soft dorsal and anal fins, and also over the snout and front of jaws; the caudal fin is white with a black margin posteriorly.

Geographical Distribution: Western Atlantic: mainly continental in distribution, from North Carolina to the Yucatan Peninsula; juveniles occur as far north as Massachusetts; rare in Bermuda (Fig. 469); one record from Cuba (Rodriguez, 1976); also reported from eastern Brazil.

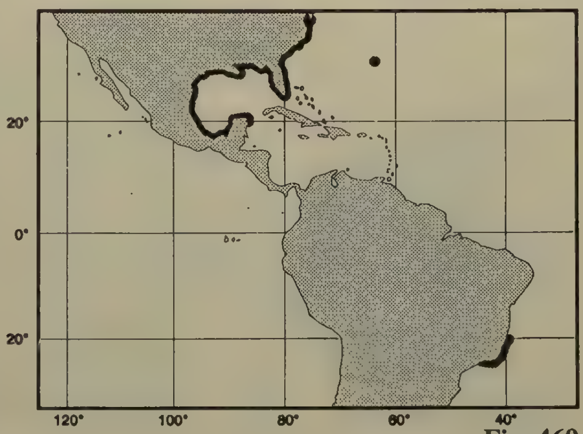


Fig. 469

Habitat and Biology: Juveniles occur in estuaries and seagrass beds; adults are usually found offshore on rocky bottom in depths of 40 to 100 m (rarely to 152 m), and occasionally inshore on rocky or grassy bottom. *M. microlepis* is the most common species of grouper on rocky ledges in the eastern Gulf of Mexico. Adults are solitary or in groups of 5 to 50 individuals well above the bottom; they feed mainly on fishes and also take some crabs, shrimps, and cephalopods. Juveniles (less than 20 cm) feed mainly on the crustaceans that live in shallow grass beds.

Spawning is thought to occur at depths greater than 70 m. Females are sexually mature at 5 or 6 years (67 to 75 cm total length) and most change sex between 10 and 11 years old (95 to 100 cm total length). Fecundity of a 95 cm female was estimated at 1.5 million eggs. Roberts and Schlieder (1983) report the artificial spawning of males produced by induced sex inversion.

Bullock and Smith (1991) reported a weight-length curve for 902 *M. microlepis* from the eastern Gulf of Mexico: $W = 2.68 \times 10^{-8}\ SL^{2.958}$ ($r^2 = 0.98$), where W is whole weight in kilogrammes and SL (standard length) is in millimetres.

Size: Maximum total length about 120 cm. The 1990 edition of *World Record Game Fishes* published by the International Game Fish Association lists the all-tackle record for *M. microlepis* as 32.11 kg for a fish caught off Destin, Florida.

Interest to Fisheries: This is one of the most important groupers in the sport and commercial fisheries of the southeast coast of the US and in the Gulf of Mexico. Caught with hook-and-line, longlines, and occasionally in trawls.

Local Names: BRAZIL: Badejo-da-areia; USA: Charcoal belly.

Literature: McErlean (1963); McErlean and Smith (1964); Smith (1971); Manooch (1984); Figueiredo and Menezes (1980); Collins et al. (1987); Keener et al. (1988); Bullock and Smith (1991); Gilmore and Jones (1992).

Remarks: Juveniles of *M. microlepis* (less than 40 cm standard length) that have not yet developed the distinctive notch and rounded lobe at the corner of the preopercle might be confused with *M. bonaci*, and preserved specimens (without indication of the original colour pattern) may be difficult to identify. *M. microlepis* has higher scales counts (lateral line 88 to 96 and lateral-scale series 128 to 146, versus 78 to 83 and 119 to 126 respectively for *M. bonaci*).

Kendall (1979) described and illustrated the larval development of specimens 4.0 to 14.2 mm that were presumed to be *M. microlepis* based on fin counts and collection locality.

Mycteroperca olfax (Jenyns, 1843)

Fig. 470

SERRAN Myct 10

Serranus olfax Jenyns, 1843:9, pl. 4 (type locality: Galapagos Islands).

Synonyms: *Mycteroperca olfax* variety *ruberrima* Jordan and Bollman in Jordan and Eigenmann, 1890:367 (type locality: Abingdon Island, Galapagos).

FAO Names: **En** - Sailfin grouper; **Fr** - Mérou voile; **Sp** - Garropa parda.

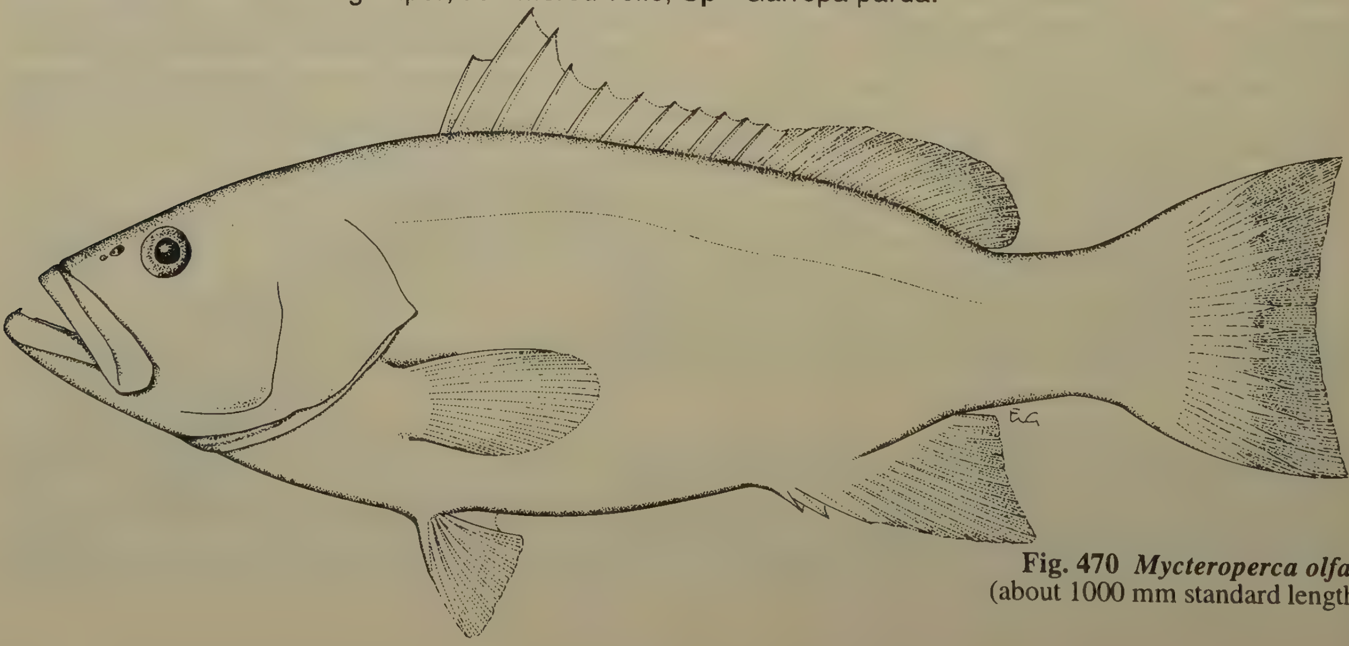


Fig. 470 *Mycteroperca olfax* (about 1000 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.9 to 3.2 times in standard length (for fish 27 to 59 cm standard length). Head length contained 2.6 to 2.9 times in standard length; interorbital slightly convex; preopercle angular, with a serrate lobe at the angle; posterior nostrils of adults (more than 40 cm standard length) greatly enlarged, more than twice size of anterior nostrils. Total gill rakers 24 to 29 (not counting rudiments). Dorsal fin with XI spines and 16 or 17 rays, the second and third dorsal-fin spines elongated, forming an elevated lobe, the interspinous membranes not deeply indented; soft-rayed part of dorsal fin rounded; anal fin with III spines and 11 rays, the fin pointed in specimens longer than 25 cm standard length; pectoral-fin rays 16 or 17; caudal fin truncate in juveniles, slightly emarginate in adults, without exserted rays. Lateral-scale series 92 to 110. **Colour**: "typically dark olive-brown on back, sides, and head, spotted with purplish and lighter brown. The belly is greyish brown. There is variation in this colour, however, even within a small geographical area. Some specimens may be plain dark brown; others may have the body covered with faint circular dark brown spots. In some, these spots may be of fairly even distinctness. These spots seem to disappear with age, but the age at which they fade varies." (Walford, 1937). A xanthic morph is bright yellow over all. Rosenblatt and Zahuranec (1967) reported that the brown colour morph has the fins margined with white, and there is a dark brown "moustache mark" above the maxilla.

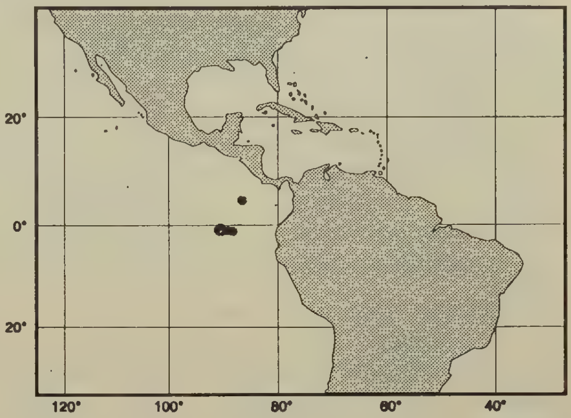


Fig. 471

Geographical Distribution: Cocos and Galapagos Islands. Rosenblatt and Zahuranec (1967) discounted reports from Panama and Peru (Fig. 471). Rosenblatt and Zahuranec (1967) and C.L. Smith (1971) overlooked Snodgrass and Heller's (1905) record of ***M. olfax*** from Cocos Island.

Habitat and Biology: Snodgrass and Heller (1905) reported ***M. olfax*** as extremely abundant at the northern and western islands of the Galapagos Archipelago. Juveniles were found in shallow sandy lagoons. Adults are primarily piscivorous.

Size: According to Walford (1937), ***M. olfax*** attains a total length of 120 cm.

Interest to Fisheries: Probably of importance in the grouper fishery of the Galapagos Islands. Caught with hook-and-line.

Local Names: ECUADOR: Colorado grouper (Galapaos Islands).

Literature: Smith (1971).

Remarks: ***M. olfax*** seems to be the only species of ***Mycteroperca*** that occurs at the Galapagos Islands.

Mycteroperca phenax Jordan and Swain, 1885 | Fig. 472; Pl. XXVIID-F | SERRAN Myct 5

Mycteroperca falcata variety ***phenax*** Jordan and Swain, 1885:363 (type locality: Key West, Florida).

Synonyms: None.

FAO Names: **En** - Scamp; **Fr** - Badèche galopin; **Sp** - Cuna garopa.

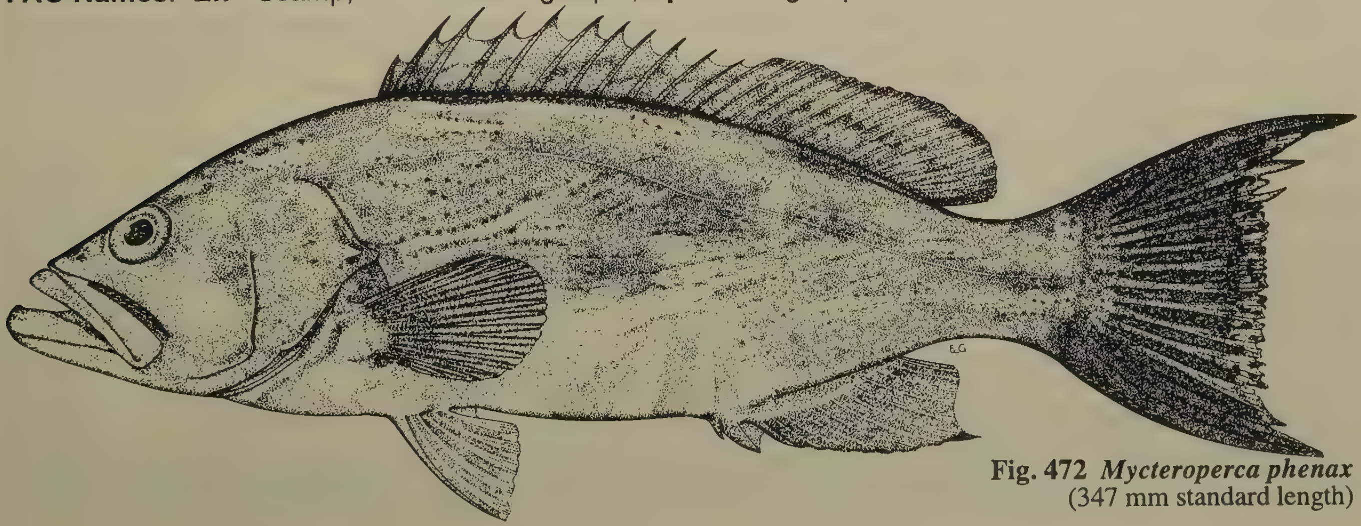


Fig. 472 ***Mycteroperca phenax***
(347 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 3.0 to 3.4 times in standard length (for fish 20 to 57 cm standard length). Head length contained 2.6 to 3.0 times in standard length; interorbital area convex; preopercle angular, with a distinct bony lobe at the angle (in fish larger than 40 cm standard length); subopercle and interopercle serrate; posterior nostrils of adults 2 to 4 times larger than anterior nostrils. Gill rakers 8 to 10 on upper limb and 17 to 21 on lower limb, 26 to 31 (total, including 3 or 4 rudiments on each limb), the longest raker longer than the longest gill filament. Dorsal fin with XI spines and 16 to 18 rays; anal fin with III spines and 10 to 12 rays; pectoral-fin rays 15 to 17; caudal fin concave; adults with unevenly exserted rays in dorsal, anal, and caudal fins. Lateral-body scales ctenoid; lateral-line scales about 76 to 82; lateral-scale series about 124. **Colour**: Four colour patterns were described and illustrated by Gillmore and Jones (1992); the usual pattern is the brown phase, with head and body pale brown, covered (except ventrally) with small reddish brown spots (1 on each scale) which extend onto the median fins. The "cat's paw" phase is pale brown, the dorsolateral parts of body with several clusters of dark brown spots resembling the paw print of a cat. Larger adults displayed a grey-head phase, with the rear two-thirds of the body dark; the head and the body anterior to the sixth dorsal-fin spine is silvery grey with dark reticulations, the light areas being the same areas that were darkly pigmented in the "cat's paw" phase; belly and ventral part of body above anal fin with several white spots; fins white except for black margin of pectoral fins. The bicolour phase, seen only once, was pale brown anteriorly and abruptly dark chocolate brown posteriorly, with the transition at the origin of the soft dorsal fin. All colour phases are ephemeral, but only large adults (over 50 cm standard length) displayed the grey-head phase.

Geographical Distribution: Gulf of Mexico and east coast of U.S. from North Carolina to Key West and along the southern shore of the Caribbean Sea; juveniles are occasionally found as far north as Massachusetts. Cervigón (1966) reported ***M. phenax*** as common at the islands of Margarita and Cubagua off the east coast of Venezuela (Fig. 473).

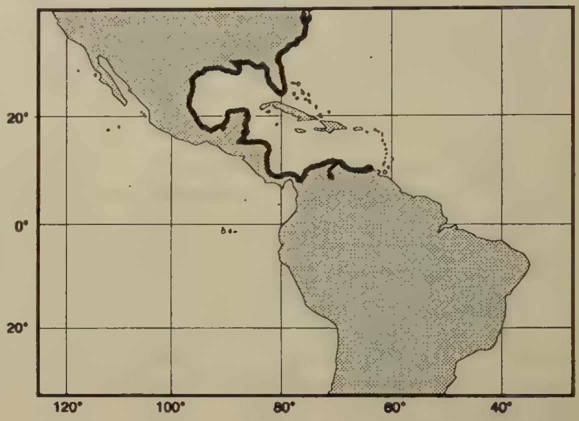


Fig. 473

Habitat and Biology: In the eastern Gulf of Mexico, ***M. phenax*** are usually found over ledges and high-relief rocky bottoms (Bullock and Smith, 1991); but according to Manooch (1984), the preferred habitat from North Carolina to Georgia is low-profile bottoms in depths of 30 to 100 m. Off the east coast of Florida, Gilmore and Jones (1992) found that scamp were the most abundant grouper in areas of living *Oculina* coral formations at depths of 70 to 100 m. This species apparently moved inshore when bottom temperature fell below 8.6 °C. These authors suggested that, because of their relatively small size, ***M. phenax*** are restricted to areas of topographic complexity where they can find shelter from predators such as sharks and large amberjack (*Seriola dumerili*). Juveniles have been found in shallow water at jetties and in mangrove areas.

The biology of ***M. phenax*** from off the Carolinas was studied by Matheson et al. (1986). They found that scamp grow slowly and attain an age of at least 21 years. Their calculated von Bertalanffy growth equation is: $L_t = 985(1-e^{-0.092(t+245)})$ where L_t is fork length in millimetres at year t. Their equation describing the relationship of weight to length is $W = 2.46 \times 10^{-8}(L^{2.913})$ with L (fork length) in millimetres and W (weight) in kilogrammes.

Spawning of the Carolinas population occurred from April through August, with a peak in May and June. Maturity is attained at 3 years (40 cm). For the Gulf of Mexico population, Bullock and Smith (1991) reported spawning from March through May and maturity for females at 35 cm standard length; ovulated eggs, 0.75 to 1.23 mm in diameter, were transparent with a single oil droplet. The weight/length curve, based on 1 216 scamp, is $W = 1.104 \times 10^{-7}\ SL^{2.74}$ ($r^2 = 0.95$), where W is whole weight in kilogrammes, and SL (standard length) is in millimetres.

Food of ***M. phenax*** comprises mainly fishes and a few crustaceans and *Octopus*.

Size: Maximum total length (not including exserted caudal-fin rays) is 90 cm, maximum weight about 14 kg.

Interest to Fisheries: ***M. phenax*** is the most highly prized grouper in the fisheries of the Gulf of Mexico and southeastern U.S. From 1973 to 1979, it represented 34% of the total weight of grouper (348 t) in the South Atlantic Bight recreational fishery (Matheson et al., 1986).

Local Names: VENEZUELA: Cuna garopa.

Literature: Cervigón and Velasquez (1966); C.L. Smith (1971).

Remarks: Although adult ***M. phenax*** and ***M. interstitialis*** are very similar (see Remarks in the account of ***M. interstitialis*** above), the juveniles of ***M. phenax*** are not bicoloured like those of ***M. interstitialis***.

Mycteroperca prionura Rosenblatt and Zahuranec, 1967

Fig. 474

SERRAN Myct 11

Mycteroperca prionura Rosenblatt and Zahuranec, 1967:241, figs 3A and 4A (type locality: Baja California Sur, Inner Gorda Bank, 23°02'N, 109°31'W).

Synonyms: ***Mycteroperca xenarcha*** (non Jordan): Walford, 1937.

FAO Names: **En** - Sawtail grouper; **Fr** - Mérou scie-queue; **Sp** - Garropa aserrada.

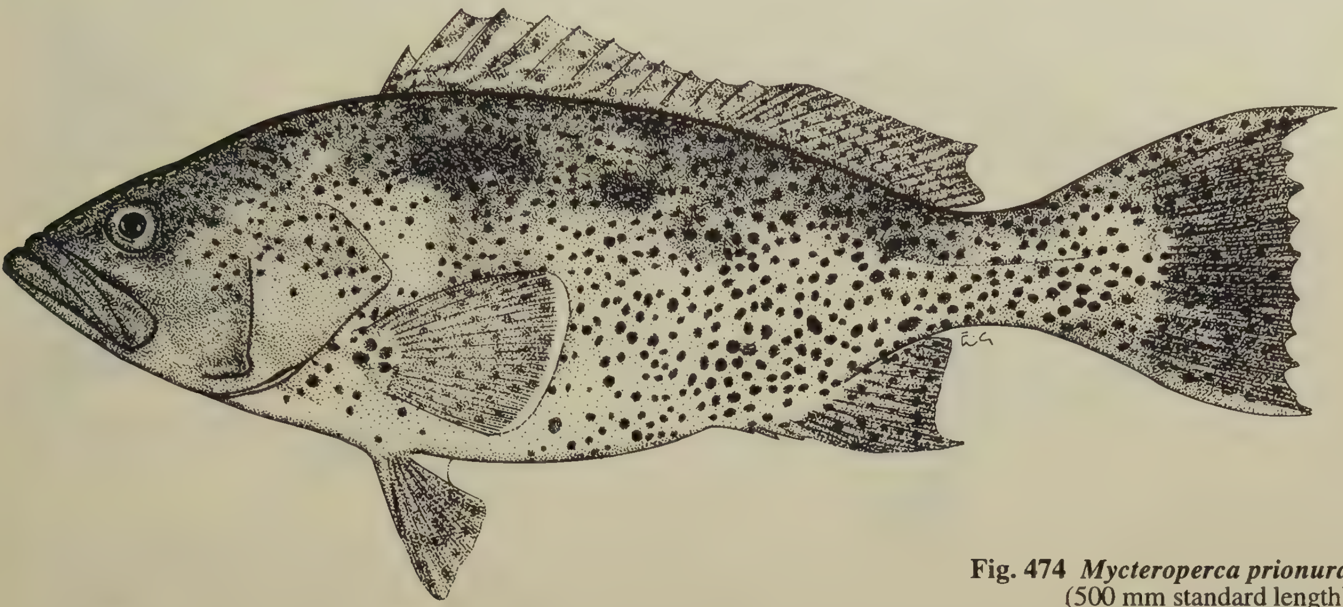


Fig. 474 ***Mycteroperca prionura***
(500 mm standard length)

Distinctive Features: Body depth less than head length. Preopercle angular, with a serrate lobe at the angle; posterior nostrils not greatly enlarged in adults. Total gill rakers 34 to 38, not counting rudiments. Dorsal fin with XI spines and 16 to 18 rays, the third spine longest, but not much longer than fourth, the succeeding spines gradually shortening to the tenth, which is slightly shorter than the last spine, the interspinous membranes not indented; anal fin with III spines and 10 to 12 rays; margin of soft dorsal and anal fins pointed in fish larger than 35 cm standard length; pectoral-fin rays 15 or 16; caudal fin of juveniles (less than 20 cm standard length) rounded or truncate; in adults (larger than 25 cm standard length), rear margin of caudal fin scalloped, with exserted rays. Lateral-scale series 85 to 109. **Colour**: Adults pale brown, the body, median fins, and rear part of head (except ventrally) covered with small dark reddish brown spots; pectoral fins and pelvic fins dusky, with faint irregular dark spots; live fish may show dusky blotches on dorsolateral part of body. Juveniles less than 10 cm standard length yellowish tan, with round, well-spaced, reddish brown spots on body and similar but smaller spots on head and median fins; dark stripe from eye to tip of lower jaw. With growth, the dark spots on the body become smaller and more numerous. A colour photograph of a large juvenile (ca. 30 cm total length) was published by Burgess and Axelrod (1984).

Geographical Distribution: Eastern Pacific, Gulf of California south to Jalisco, Mexico (Fig. 475).

Habitat and Biology: ***M. prionura*** is found on rocky reefs at depths of 8 to at least 40 m. No information is available on the biology.

Size: Rosenblatt and Zahuranec (1987) reported their largest specimen as 68 cm standard length.

Interest to Fisheries: ***M. prionura*** is apparently too rare to be of significant commercial importance.

Local Names:

Literature: Rosenblatt and Zahuranec (1967).

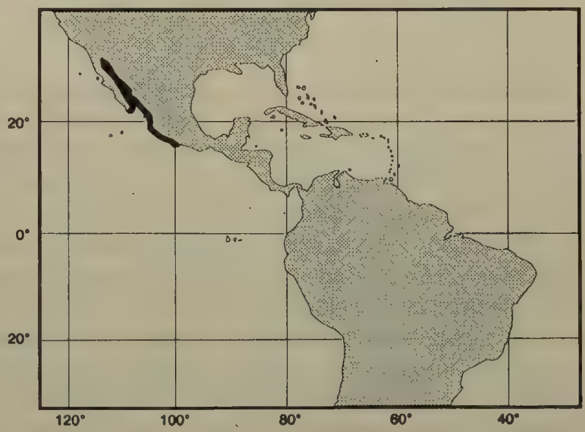


Fig. 475

Remarks: ***M. jordani*** and ***M. xenarcha*** differ from ***M. prionura*** in having fewer gill rakers (21 to 26 and 29 to 33 total, not counting rudiments), and ***M. rosacea*** has more gill rakers (38 to 43 total, not counting rudiments); in addition, adults of ***M. jordani*** and ***M. rosacea*** lack exserted caudal-fin rays and a distinctly projecting lobe at the angle of the preopercle.

Mycteroperca rosacea (Streets, 1877)

Fig. 476; Pl. XXVIIIA

SERRAN Myct 12

Epinephelus rosaceus Streets, 1877:51 (type locality: Angel Island, Gulf of California).

Synonyms: *Mycteroperca pardalis* Gilbert, 1892:551 (type locality: La Paz Bay, Baja California).

FAO Names: **En** - Leopard grouper; **Fr** - Mérou léopard; **Sp** - Cabrilla sardinera.

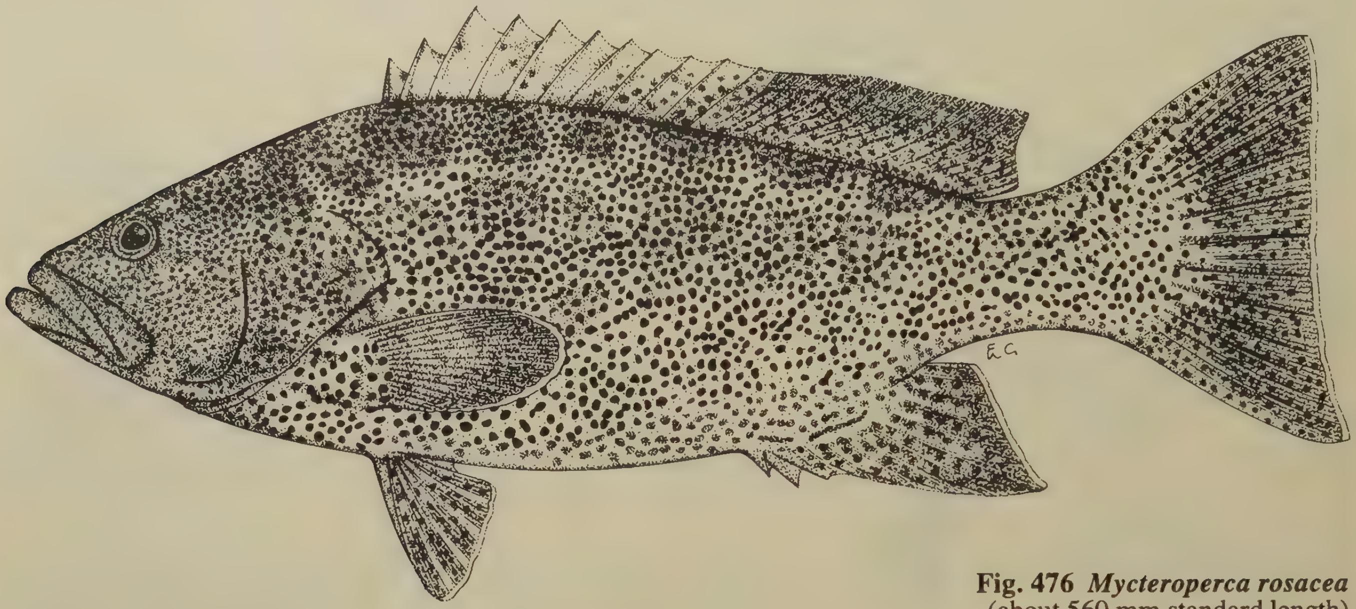


Fig. 476 ***Mycteroperca rosacea***
(about 560 mm standard length)

Diagnostic Features: Body depth less than or subequal to head length, depth contained 2.7 to 3.1 times in standard length (for fish 11 to 61 cm). Head length contained 2.6 to 2.8 times in standard length; preopercle angle of adults with a weakly-developed serrate lobe; posterior nostrils of large adults 2 or 3 times larger than anterior nostrils. Total gill rakers 38 to 43, more than 21 rakers on lower limb. Dorsal fin with XI spines and 16 to 18 rays, the interspinous membranes distinctly indented, the margin of soft-rayed part of fin in large adults with a low point posteriorly; anal fin with III spines and 10 or 11 rays, the fin margin pointed (except in small juveniles) with fifth or sixth ray elongated; pectoral-fin rays 15 to 17; no exserted fin rays; caudal fin truncate or concave posteriorly, without exserted rays projecting beyond the fin membranes. Midlateral-body scales ctenoid; lateral-line scales 72 to 77; lateral-scale series 106 to 120. **Colour**: Two colour patterns: the more common one is greenish to greyish brown, covered with small reddish brown spots and irregular pale spots and lines, the fins with a white margin; the second pattern is exhibited by a few juveniles (less than 5%) that change from the usual brown-spotted pattern to a bright yellow-orange, often with a few irregular black spots.

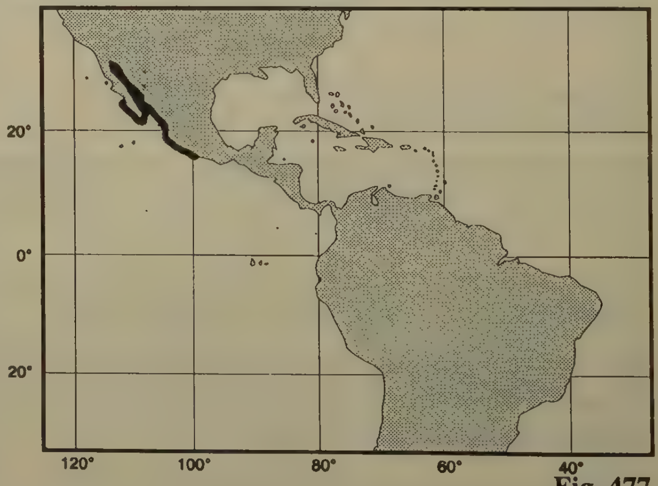


Fig. 477

Geographical Distribution: Eastern Pacific, from southwest coast of Baja California throughout the Gulf of California to Jalisco, Mexico (Fig. 477).

Habitat and Biology: *M. rosacea* prefers rocky areas in shallow water, and it is not found deeper than 50 m. Hobson (1968) did an intensive study of the predatory behaviour of this species. Adults feed primarily on the flatiron herring, *Harengula thrissina* (Jordan and Gilbert), and anchoveta, *Cetengraulis mysticetus* (Günther), when these schooling species are available. If these clupeiods are not available, adults feed on other schooling fishes and, to a lesser extent, on non-schooling fishes. Most feeding occurs at dawn and dusk, with a peak in activity about 20 minutes after sunset. Schooling fishes are usually attacked from below, with a quick rush that often carries the fish right out of the water. Juvenile *M. rosacea* (less than 30 cm) feed throughout the day on a variety of benthic fishes and crustaceans, but they also take schooling fishes at dawn and dusk and some prey at night. Juveniles and small adults often follow other fishes (especially moray eels) and octopus that are foraging over the reef in order to catch small fishes and invertebrates flushed out by the foraging species (Strand, 1988).

Size: Maximum total length about 70 cm.

Interest to Fisheries: This abundant species is undoubtedly important in local fisheries of the Gulf of California. It is caught with hook-and-line and speared by divers.

Local Names: MEXICO: Cabrilla calamaria, Cabrilla pintita, Golden grouper.

Literature: Rosenblatt and Zahuranec (1967); Thomson et al. (1979); Montgomery (1975).

Remarks: ***M. rosacea*** has more gill rakers than any of the other species of ***Mycteroperca*** in the eastern Pacific. It also differs from ***M. prionura*** and ***M. xenarcha*** in lacking the exserted caudal-fin rays that are typical of large adults of these two species.

Mycteroperca rubra (Bloch, 1793)

Fig. 478; Pl. XXVIIIB

SERRAN Myct 6

Epinephelus ruber Bloch, 1793:22, pl. 331 (type locality probably eastern Atlantic or Mediterranean; given erroneously by Bloch as "Japan").

Synonyms: ?***Serranus nebulosus*** Cocco, 1833:21 (type locality: Messina; preoccupied by ***Serranus nebulosus*** Valenciennes, 1828). ?***Serranus tinca*** Cantraine, 1835:207 (type locality: Messina). ***Cerna macrogenis*** Sassi, 1846:139 (type locality: Ligurian Sea). ?***Serranus armatus*** Osorio, 1895:174 (type locality: eastern Atlantic, São Tomé).

FAO Names: En - Mottled grouper (formerly: Comb grouper); **Fr** - Badèche rouge (formerly: Mérou royale); **Sp** - Gitano.

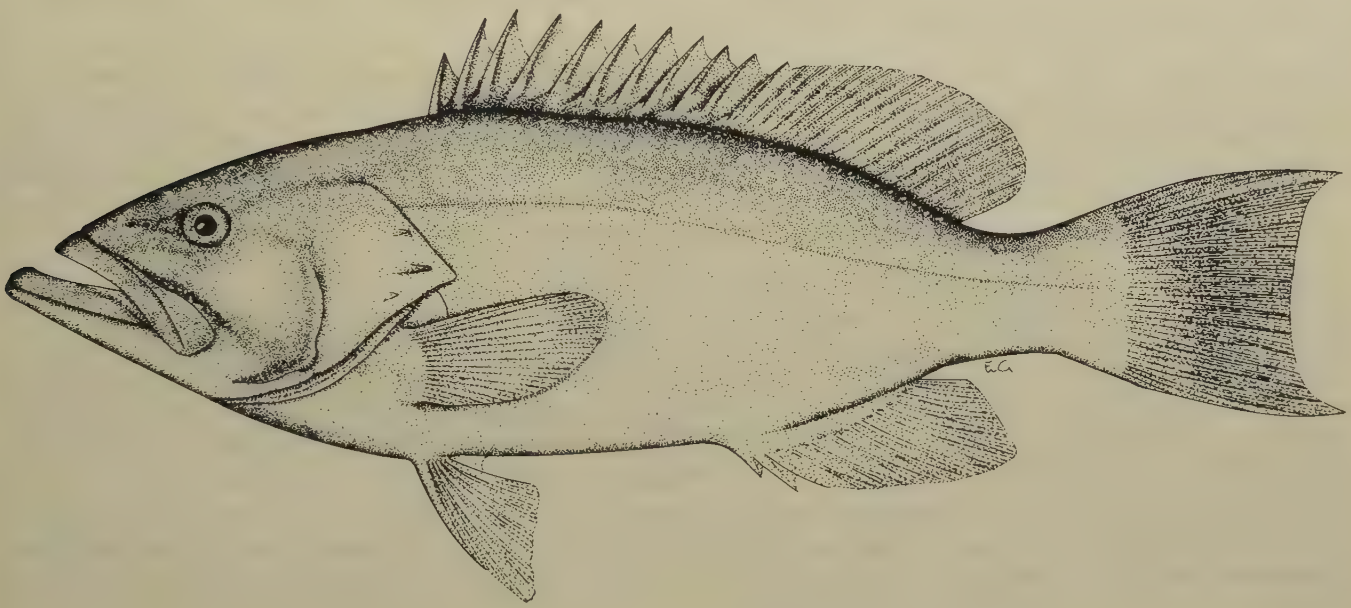


Fig. 478 ***Mycteroperca rubra***
(490 mm standard length)

Diagnostic Features: Body oblong, compressed, the depth less than head length, depth contained 2.8 to 3.2 times in standard length (for fish 17 to 59 cm standard length). Head length contained 2.5 to 2.7 times in standard length; interorbital area convex; preopercle serrae enlarged at the angle, forming a rounded lobe set off by the indentation immediately above; nostrils subequal in juveniles, the diameter of rear nostrils about twice that of front ones in a fish of 59 cm standard length; maxilla width 3.8 to 4.5% of standard length for fish 17 to 37 cm standard length, 4.8% of standard length for a fish of 59 cm standard length. Gill rakers 16 to 18 on upper limb and 28 to 31 on lower limb (including 1 to 3 rudiments on each limb), total 44 to 49. Dorsal fin with XI spines and 15 to 17 rays, the interspinous membranes distinctly indented, the posterior margin of fin rounded; anal fin with III spines and 11 or 12 rays, the fin margin angular in adults; pectoral-fin rays 16 or 17; caudal-fin margin convex in juveniles less than about 20 cm standard length, truncate in fish of 20 to 50 cm standard length, and concave in adults over 50 cm standard length. Lateral-line scales 69 to 76; lateral-scale series 94 to 108. **Colour:** Generally uniform reddish brown; sometimes mottled with blackish or pale grey spots; a black streak above maxilla. Juveniles with a black saddle blotch on peduncle.

Bauchot and Pras (1980:pl. 10) show a brownish fish with irregular white spots and blotches on body, dorsal part of head and dorsal fin; 2 dark stripes from eye towards pectoral fin.

Geographical Distribution: Continental shores of the eastern Atlantic Ocean from Portugal to southern Angola. Probably all of the records of "*Mycteroperca rubra*" from the Mediterranean and shores of Europe and Africa are based on this species. We have examined specimens from Italy, Lebanon, Israel, Egypt, Algiers, and Angola (Fig. 479). Reports of *M. rubra* from islands of the eastern Atlantic require confirmation; all of the 18 specimens of *Mycteroperca* that Heemstra (1991) examined from Madeira, the Azores, the Canary Islands, and the Cape Verde Islands are *M. fusca*.

Habitat and Biology: Rocky and sandy bottoms in depths of 15 to 200 m. According to Bini (1968), *M. rubra* feeds on molluscs (presumably cephalopods) and small fishes.

Size: Maximum total length at least 80 cm. We examined a 59 cm standard length (75 cm total length) specimen from Angola at the Museu Bocage in Lisbon.

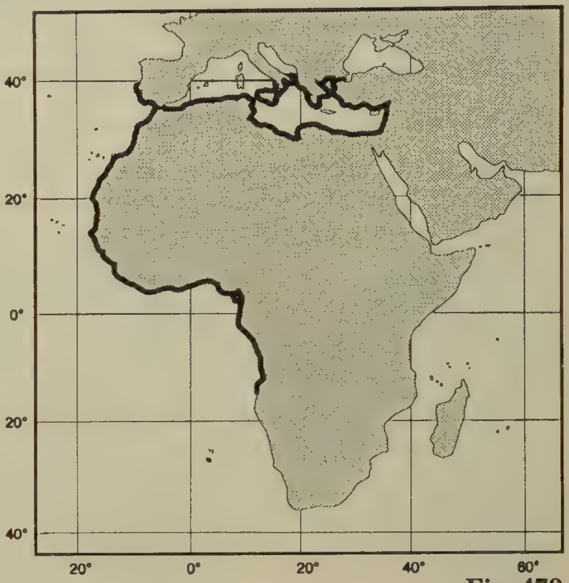


Fig. 479

Interest to Fisheries: *M. rubra* is probably of some commercial importance in fisheries of the Mediterranean and along the west coast of Africa. In the Mediterranean, it does not seem to be as common as species of *Epinephelus*. Bouain et al. (1983) state that it is rare in Tunisian waters. According to Séret (1981) it is very common along the coast of Senegal.

Local Names: FRANCE: Badèche rouge, Mérou royal; GREECE: Piga; ITALY: Cernia rossa; ISRAEL: Miktorit; PORTUGAL: Badejo; SPAIN: Gitano; TURKEY: Tashanisi.

Literature: We presume that all of the literature based on "*Mycteroperca rubra*" from the continental coast of Africa and the Mediterranean pertains to *M. rubra* rather than *M. fusca* (which is known only from islands of the eastern Atlantic) or *M. acutirostris* (of the western Atlantic). The accounts of *M. rubra* by Smith (1971) and Tortonese (1975 and 1986) pertain to all three species, but the gill-raker counts given by Smith (1971:208) are of *M. acutirostris*, and those given by Tortonese are of *M. rubra*. Furnestin et al. (1958) and Séret (1981) published good illustrations of *M. rubra*.

Remarks: Recent authors (Smith, 1971; Tortonese, 1975, 1986; Bauchot, 1987) have regarded *M. rubra* as occurring on both sides of the Atlantic Ocean. Heemstra (1991) restricted this species name to the eastern Atlantic continental population, which differs from *M. acutirostris* of the western Atlantic in having fewer gill rakers (lower-limb rakers 28 to 31, versus 32 to 36 in *M. acutirostris*) and a narrower maxilla (maxilla width 3.8 to 4.5% of standard length for 7 fish of 12 to 37 cm standard length, versus 4.4 to 5.8% of standard length in 13 *M. acutirostris* of 10 to 34 cm standard length). *M. rubra* is very similar to *M. fusca* of the eastern Atlantic Macaronesian islands, but the latter has only 20 to 24 lower gill rakers.

In the original description of *Epinephelus ruber* Bloch, the type locality was given erroneously as "Japan". Gill-raker counts of the holotype of *M. rubra* (17 on upper limb and 31 on lower limb of left side and 18 on upper limb and 31 on lower limb of right side) indicate that it came from the continental shores of the eastern Atlantic.

Mycteroperca tigris (Valenciennes, 1833)

Fig. 480; Pl. XXVIIIC,D

SERRAN Myct 7

Serranus tigris Valenciennes in Cuv. and Val., 1833:440 (type locality: Santo Domingo, Dominican Republic).

Synonyms: *Serranus camelopardalis* Poey, 1860:132 (type locality: Cuba). *Serranus felinus* Poey, 1860:134 (type locality: Cuba). *Serranus rivulatus* Poey, 1860:135 (type locality: Cuba). *Serranus repandus* Poey, 1860:135 (type locality: Cuba). *Trisotropis reticulatus* Gill, 1865:105 (type locality: Barbados). *Mycteroperca hopkinsi* Jordan and Rutter, 1898:105 (type locality: Jamaica).

FAO Names: **En** - Tiger grouper; **Fr** - Badèche tigre; **Sp** - Cuna gata.

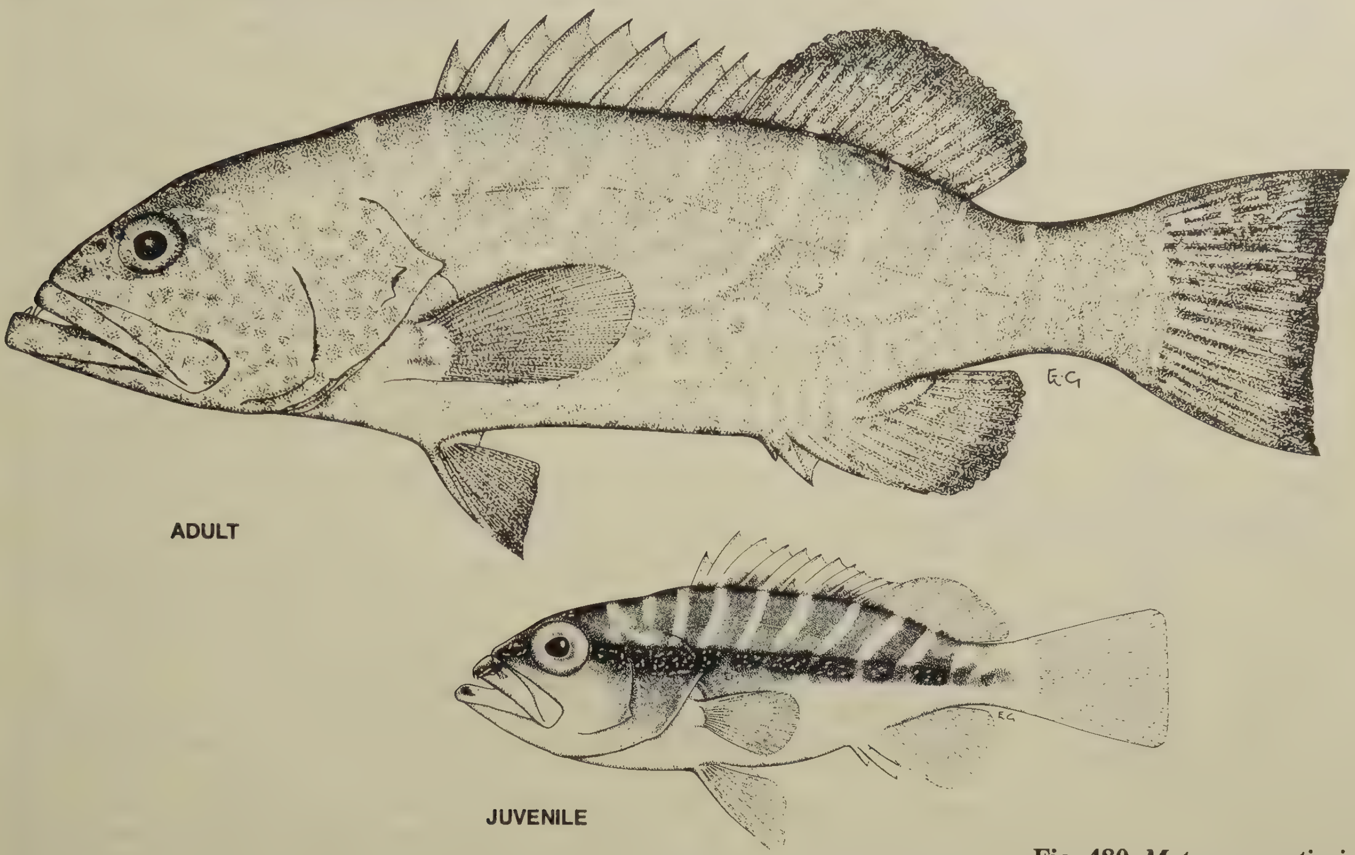


Fig. 480 *Myteroperca tigris*
(adult 372 mm standard length, juvenile 39 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 3.1 to 3.6 times in standard length (for fish 19 to 43 cm standard length). Head length contained 2.5 to 2.8 times in standard length; interorbital area flat; preopercle rounded, without a lobe at "corner"; diameter of posterior nostrils 3 to 5 times larger than anterior nostrils in fish larger than 40 cm; teeth large, canines well developed. Gill rakers short, 8 on upper limb and 15 to 17 on lower limb (including 5 or 6 rudiments on upper limb and 8 or 9 on lower limb), total 23 to 25. Dorsal fin with XI spines and 15 to 17 rays, the interspinous membranes distinctly indented; anal fin with III spines and 11 rays; in large adults the soft dorsal and anal fins are pointed, with the middle rays elongate; pectoral-fin rays 17; caudal fin rounded in juveniles, truncate to emarginate in adults; in fish larger than 60 cm, the caudal-fin rays are exserted. Midlateral-body scales ctenoid in juveniles, smooth in adults; lateral-line scales 82 to 83; lateral-scale series about 120. **Colour**: Adults greenish brown to brownish grey with pale rivulations; head and body darker dorsally, with 9 to 11 wavy oblique pale stripes; median fins with irregular pale spots and stripes; pectoral fins pale yellow distally. Live coloration of small juveniles (25 to 100 mm standard length) yellow, with a blackish brown midlateral stripe from tip of lower jaw through eye and along body almost to caudal fin (P. Colin, pers. comm.). The longitudinal stripes of the left and right sides do not meet on the lower jaw, and they become fainter with growth, being mostly obscured by the dark oblique dorsal bars of the adult colour pattern on fish of about 20 cm standard length. Bardach et al. (1958:fig. 2a) illustrated a juvenile 39 mm standard length with the bicoloured pattern of preserved specimens: the dorsal half of head and body is dark, crossed by 11 oblique pale lines.

Geographical Distribution: Western Atlantic: Bermuda, south Florida, Gulf of Mexico, Bahamas, Cuba, Haiti, Jamaica, Virgin Islands, Venezuela, and probably throughout the Caribbean to southern Brazil. Dennis and Bright (1988b) suggested that *M. tigris* was transient species in the northwestern Gulf of Mexico, but that it has recently become abundant on the Flower Gardan Banks off Texas (Fig. 481).

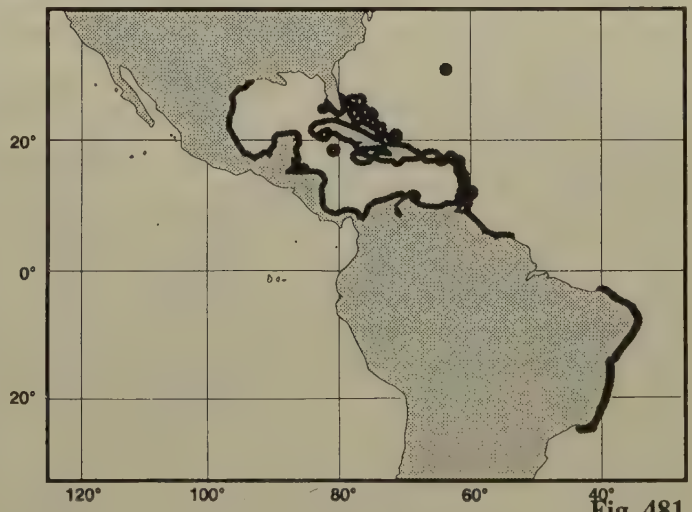


Fig. 481

Habitat and Biology: Coral reefs and rocky bottom in depths of 10 to 40 m; common in shallow water at Bermuda (C.L. Smith, 1958). The size versus sex distribution of the Bermuda population indicates that *M. tigris* is a protogynous hermaphrodite: all fish less than 37 cm total length were females and all fish larger than 45 cm total length were males (Smith, 1958).

Randall (1967) found that the food of 59 specimens of 15 to 57 cm standard length were 100% fishes of a variety of species. According to Nagelkerken (1981), ***M. tigris*** does not cruise over the reef like ***M. interstitialis***; instead, it is an ambush predator that hides among the coral and sponges and is easy for divers to approach.

Size: Maximum total length 100 cm; maximum weight at least 10 kg.

Interest to Fisheries: *M. tigris* is of commercial importance in Bermuda and of minor interest in the Caribbean area. Caught with traps, hook-and-line (including trolled lures), and with spear.

Local Names: BERMUDA: Gag; CUBA: Bonaci gato.

Literature: Smith (1971); Cervigón and Velasquez (1966); Munro (1983); Bullock and Smith (1990).

Remarks: In addition to its colour pattern, ***M. tigris*** differs from the other western Atlantic species of ***Mycteroperca*** in having fewer gill rakers (9 to 16 developed rakers on lower limb in the other species) and the interorbital part of the head is flat (convex in the other species). ***M. venenosa*** and ***M. bonaci*** also have the rear nostrils of adults not much bigger than the anterior nostrils and no exserted caudal-fin rays. ***M. phenax***, ***M. interstitialis***, and ***M. microlepis*** also have a prominent serrated lobe at the corner of the preopercle.

Mycteroperca venenosa (Linnaeus, 1758) Fig. 482; Pl. XXVIIIE,F SERRAN Myct 8

Perca venenosa Linnaeus, 1758:292 (type locality: America).

Synonyms: ***Bonaci cardenal*** Parra, 1787:29, pl. 16, fig. 1 (type locality: Cuba). ***Bodianus apua*** Bloch, 1790:50, pl. 229 (type locality: probably Brazil, based on a drawing in the collection of Prince Maurice). ***Johnius guttatus*** Bloch and Schneider, 1801:77 (type locality: Cuba; after Parra, 1787). ***Bodianus marginatus*** Bloch and Schneider, 1801:331 (type locality: probably Brazil; after Marcgrave). ***Serranus cardinalis*** Valenciennes in Cuv. and Val., 1828:378 (type locality: Cuba; after Parra). ***Serranus rupestris*** Valenciennes in Cuv. and Val., 1833:437 (type locality: Santo Domingo, Dominican Republic). ***Serranus petrosus*** Poey, 1860:136 (type locality: Cuba). ***Mycteroperca bowersi*** Evermann and Marsh, 1902:158, fig. 45 (type locality: Culebra Island, Puerto Rico).

FAO Names: **En** - Yellowfin grouper; **Fr** - Badèche de roche; **Sp** - Cuna de piedra.

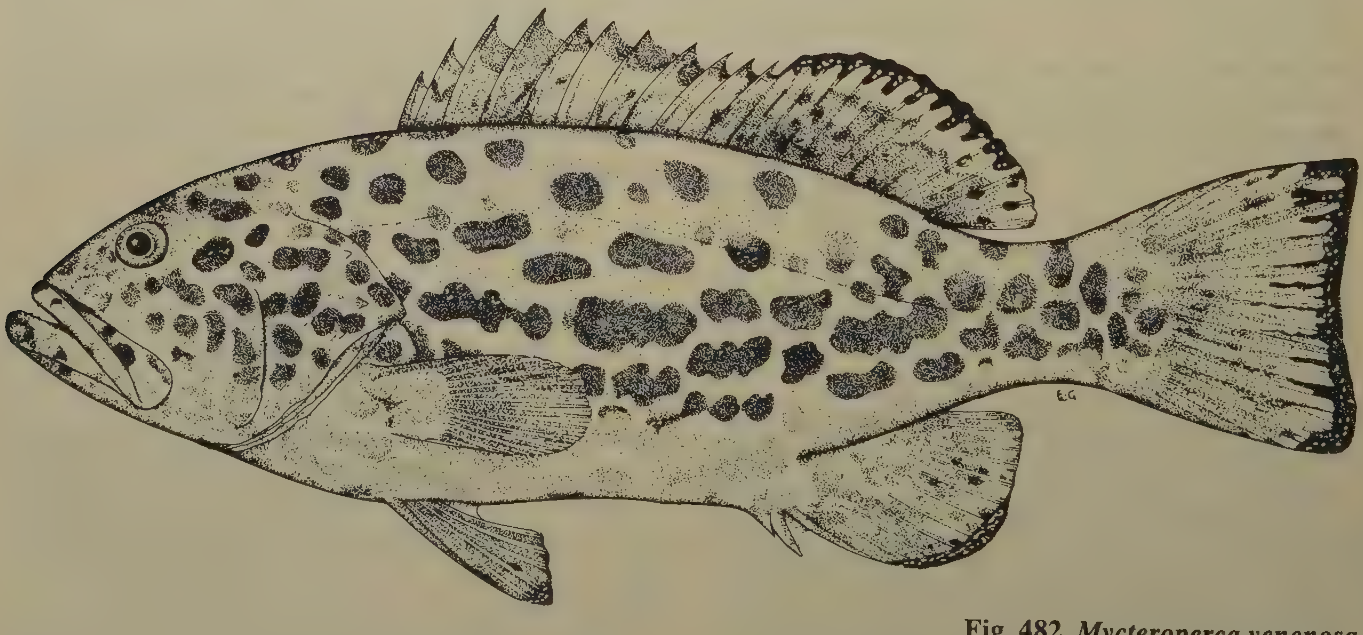


Fig. 482 ***Mycteroperca venenosa***
(235 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.9 to 3.2 times in standard length (for fish 15 to 54 cm standard length). Head length contained 2.6 to 2.9 times in standard length; interorbital area convex; preopercle evenly rounded or with a slight notch, but no projecting bony lobe at the angle; nostrils subequal or rear nostrils about twice diameter of anterior nostrils. Gill rakers 8 to 10 on upper limb and 17 or 18 on lower limb, including 4 to 7 rudiments on each limb, total 24 to 27. Dorsal fin with XI spines and 15 or 16 rays, the interspinous membranes distinctly indented between the spines; anal fin with III spines and 10 to 12 rays; soft dorsal- and anal-fin margins rounded; no exserted dorsal- and anal-fin rays; pectoral-fin rays 16 to 18; caudal fin truncate in juveniles, concave in adults. Midlateral-body scales ctenoid in juveniles, smooth in adults, with numerous auxiliary scales; lateral-line scales 72 to 81; lateral-scale series 111 to 125. **Colour**: Two colour morphs: a deep-water reddish form and a shallow-water greenish form; both colour morphs show the following markings: head and body with oblong dark blotches overlying groups of small black spots; ventral part of head and body with small, dark red spots; soft dorsal, anal, and caudal fins with dark margin and white edge; distal third of pectoral fins abruptly yellow, the basal part of fin with small, irregular dark spots.

Geographical Distribution: Western Atlantic: Bermuda (common), Bahamas, Gulf of Mexico (rare), Cuba, Jamaica, Virgin Islands, Honduras, Nicaragua, Venezuela (common at Islas Los Roques and Blanquilla), and south to São Paulo, Brazil (Fig. 483).

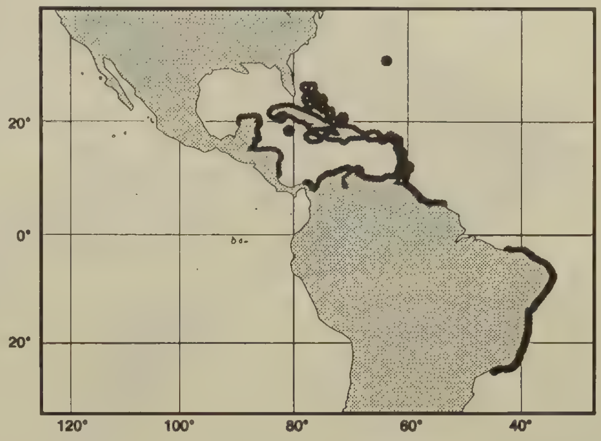


Fig. 483

Habitat and Biology: Juveniles occur in shallow turtle grass beds; adults are usually found on rocky and coral reefs in depths of 2 to 137 m, but *M. venenosa* has also been taken in trawls over mud bottom in the northern Gulf of Mexico. Spawning occurs at Bermuda in July, in the Florida Keys during March, and on the Florida Middle Ground in the eastern Gulf of Mexico from March to August. Batch fecundity estimates of vitellogenic eggs for two ripe fish, 696 and 725 mm standard length, (from data of Bullock and Smith, 1991) are 2.0 x 10^6 and 2.8 x 10^6 respectively. Ovulated eggs were 0.80 to 1.16 mm in diameter, transparent with a single oil droplet. Ripe males as small as 54 cm standard length were found in the Florida Keys population. The egg count of 1 425 443 given by C.L. Smith (1961) for a fish of unspecified length with a gonad weighing only 120.8 g and a sample of gonad tissue with 1 003 eggs weighing 0.85 g, is wrong by a factor of 10; the correct egg total for this gonad is

$$(120.8/0.85) \times 1003 = 142\,544 \text{ eggs.}$$

Randall (1967) examined the stomach contents of 51 *M. venenosa* (18 to 75 cm standard length); the food was 95% fishes (mainly coral reef species) and 4% squid.

Size: Attains at least 90 cm total length. The 1990 edition of World Record Game Fishes published by the International Game Fish Association list the all-tackle record for *M. venenosa* as a 15.43 kg fish caught at Largo, Florida.

Interest to Fisheries: The yellowfin grouper is one of the more important commercial fishes in Bermuda and is one of the most abundant groupers in the Caribbean area. Although it is often implicated in ciguatera poisonings (as its name implies), *M. venenosa* is a desirable food fish; and even large (5 to 10 kg) fish from areas considered safe are sold in markets. Caught with traps, spear and hook-and-line (including surface trolling).

Local Names: BERMUDA: Red rockfish, Princess rockfish; CUBA: Bonaci cardenal, Arigua, Bonaci de piedra; VENEZUELA: Cuna cucaracha.

Literature: Cervigón and Velasquez (1966); Brownell and Rainey (1971); Smith (1971); Thompson and Munro (1978); Bullock and Smith, 1991.

Remarks: *M. cidi*, *M. interstitialis*, *M. microlepis*, and *M. phenax*, differ from *M. venenosa* in having a projecting bony lobe at the corner of the preopercle; adults of *M. cidi*, *M. interstitialis*, and *M. phenax* also have exserted caudal-fin rays; and *M. microlepis* has more lateral-line scales (88 to 96). *M. tigris* differs from *M. venenosa* in having fewer gill rakers (4 to 8 developed rakers on lower limb), interorbital area flat, adults with exserted caudal-fin rays, and rear nostrils 3 to 5 times larger than anterior nostrils. *M. bonaci* differs from *M. venenosa* in colour pattern.

Mycteroperca xenarcha Jordan, 1888

Fig. 484

SERRAN Myct 13

Mycteroperca xenarcha Jordan, 1888:387 (type locality: "James Island, Galapagos" [probably erroneous] see Remarks, below).

Synonyms: *Mycteroperca boulengeri* Jordan and Starks in Jordan, 1895:445, pl. 38 (type locality: Mazatlan, Mexico).

FAO Names: **En** - Broomtail grouper; **Fr** - Mérou genêt-queue; **Sp** - Mero brujo.

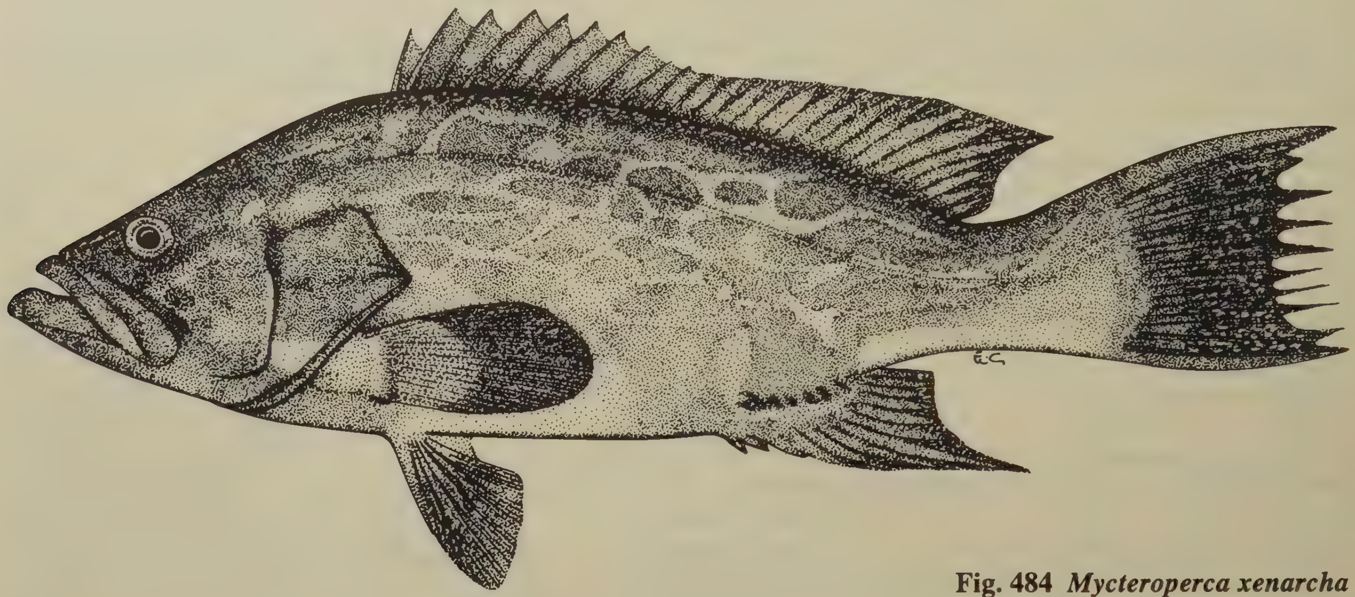


Fig. 484 ***Mycteroperca xenarcha***
(about 700 mm standard length)

Diagnostic Features: Body depth less than head length, depth contained 2.9 to 3.1 times in standard length (for fish 16 to 60 cm standard length). Head length contained 2.6 to 2.8 times in standard length; preopercle angular, with a distinct serrate lobe at the angle; posterior nostrils not notably larger than anterior nostrils. Gill rakers 29 to 33 (total, not counting rudiments). Dorsal fin with XI spines and 15 or 16 rays, the interspinous membranes not indented, the margin of the soft-rayed part becomes pointed (with rays 9 to 11 elongated) in fish larger than 20 cm; anal fin with III spines and 10 or 11 rays, the fin margin also pointed (rays 4 to 6 elongated) in fish larger than 10 cm; pectoral-fin rays 16 to 18; caudal fin truncate, with exserted rays in fish larger than 20 cm standard length. **Colour**: Two colour patterns: The blotched pattern is brown, grey, or greyish green, with oblong dark blotches (most enclosing a pale line) dorsally, close-set in juveniles, forming an irregular maze-like, pale reticulum; in adults the dark blotches are more widely spaced, with the pale reticulum expanded to form a general pale ground colour; ventral part of body with irregular dark elongate markings; juveniles with conspicuous black saddle on caudal peduncle. The plain colour pattern is uniform greyish or brown, the fins darker and edged with white. Large adults are mostly plain, but may assume the blotched pattern momentarily.

Geographical Distribution: Eastern Pacific: Southern California (one sight record from San Francisco Bay), Baja California, Gulf of California south to Peru (Fig. 485). One record (the holotype) purported to be from the Galapagos; see Remarks below.

Habitat and Biology: According to Thomson et al. (1979), *M. xenarcha* prefers mangrove estuaries. Adults and juveniles occur in shallow water, and adults are also found to depths of 60 m.

Size: Maximum total length about 150 cm; maximum weight at least 45 kg.

Interest to Fisheries: Because of its large size, the broomtail grouper is of interest to anglers and spearfishermen.

Local Names: MEXICO: Mangrove grouper (Gulf of California).

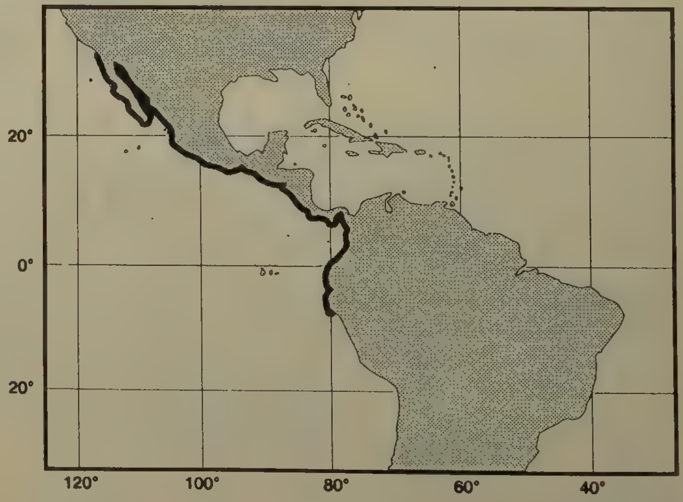


Fig. 485

Literature: Walford (1937).

Remarks: Rosenblatt and Zahuranec (1967) question the place of origin of the holotype: "Although the type locality of ***M. xenarcha*** is James Island, Galapagos Islands, the species has not been taken at the Galapagos since, despite much subsequent collecting. It may be of some significance that the only Peruvian record of ***M. olfax*** [otherwise known only from the Galapagos] is a specimen also taken on the Hassler Expedition. It is tempting to speculate that locality labels were somehow switched on these two specimens. However, there is nothing in the catalogues at the Museum of Comparative Zoology to confirm this speculation. Although the two are in the same bottle, each bears what appears to be an original field label indicating James Island as the locality for the holotype of ***M. xenarcha*** and Paita, Peru as the locality for the ***M. olfax***."

M. jordani differs in having a projecting bony lobe at the corner of the preopercle, fewer gill rakers (total 21 to 26), and no exserted median fin rays. ***M. prionura*** has more gill rakers (total 34 to 38) and the body covered with small, dark reddish brown spots. ***M. rosacea*** has more gill rakers (38 to 43) and no exserted fin rays.

Paranthias Guichenot, 1868

SERRAN Parant

Paranthias Guichenot, 1868:87; type species, ***Serranus furcifer*** Valenciennes, 1828 by monotypy.

Synonyms: ***Brachyrhinus*** Gill, 1863:236; type species, ***Serranus creolus*** Valenciennes, 1828 (= ***Paranthias furcifer***) by monotypy; preoccupied by ***Brachyrhinus*** Latreille, 1802. ***Creolus*** Jordan and Gilbert, 1883:36; type species, ***Serranus furcifer*** Valenciennes by monotypy; listed in Table of Contents as if in Addenda, but replaced on page 973 by ***Paranthias*** Guichenot.

Diagnostic Features: Body oblong, fusiform, dorsal and ventral profiles almost equally curved, the depth contained 2.7 to 3.4 times in standard length, the body width contained 1.8 to 2.5 times in the depth. Head length contained 3.2 to 4.0 times in standard length; snout short, subequal to eye diameter (except in large adults); dorsal head profile convex; preorbital depth less than half eye diameter, preorbital depth contained 10 to 14 times in head length; interorbital area flat or slightly convex; preopercle subangular, with vertical limb and rear half of lower limb finely serrate; upper edge of operculum slightly convex; nostrils subequal; mouth small, the maxilla not reaching past vertical at centre of eye; no knob or step on ventral edge of maxilla; supramaxilla vestigial or absent; jaws with rudimentary canines; teeth present on palatines and in an oval patch on vomer. Dorsal fin with IX spines and 17 to 21 rays, the fin origin posterior to vertical at pectoral-fin base; the interspinous membranes slightly indented; no dorsal-fin spines or rays elongated; base of spinous dorsal-fin part shorter than base of soft-rayed part; soft dorsal-fin margin rounded; anal fin with III spines and 8 to 11 rays, the fin margin straight; pectoral fins distinctly longer than pelvic fins, pectoral-fin length contained 0.9 to 1.2 times in head length, the middle rays longest; caudal fin distinctly forked, the middle rays less than half length of upper or lower caudal lobes, with 8 branched rays and 12 or 13 procurrent rays in upper part and 7 branched rays and 11 or 12 procurrent rays in lower part. Midlateral-body scales ctenoid. Supraneural bones 2, the second about two-thirds length of first; epipleural ribs on first 9 vertebrae; dorsal and anal fins with 3 to 5 trisegmental pterygiophores at rear end of fin; rear edge of first dorsal pterygiophore not excavated for tip of third neural spine; cranium short and wide, the least interorbital width more than half width at lateral ethmoids and twice width of vomer; frontals separated anteriorly by supraethmoid; well developed median crest on frontals, continuous with supraoccipital crest, but the frontal part of crest not visible in lateral view because interorbital area is recessed (concave dorsally); parasphenoid distinctly bent upwards anteriorly.

Habitat and Biology: ***Paranthias*** is a unique genus of groupers that have a "small mouth [with upper jaw more protrusile than in other groupers], small teeth, numerous [long] gill rakers, fusiform body, and deeply forked caudal fin — all representing departures from the typical grouper morphology, and all specializations for feeding in mid-water on zooplankton" (Randall, 1967). ***Paranthias*** feed mainly on small planktonic animals that are picked individually from the water, and their shortened snout (compared to other groupers), which facilitates close-range binocular vision, is thus another specialization for this type of plankton feeding. They are usually seen in feeding aggregations well above the reef, but they will retreat to the reef at the approach of danger. They are found in depths of 10 to 70 m.

Geographical Distribution: Tropical and subtropical waters of the Atlantic and eastern Pacific oceans: In the eastern Atlantic known only from Ascension Island and islands in the Gulf of Guinea. In the western Atlantic, ***P. furcifer*** is known from Bermuda, south Florida, Gulf of Mexico, Cuba, southern Bahamas, and

Caribbean to southern Brazil. In the eastern Pacific, *P. colonus* occurs from the Gulf of California to Peru, including the offshore islands (Clipperton, Galapagos, etc.).

Interest to Fisheries: The species of *Paranthias* are too small to be of commercial importance as a food fish. Probably of some interest to local fisheries at islands where they are common.

Remarks: Although Smith (1971) regarded the eastern Pacific species *P. colonus* and *P. pinguis* as synonyms of the Atlantic *P. furcifer*, our data indicate that the Atlantic and Pacific populations are sufficiently distinct to be considered separate species. In his tables of meristic data, Smith gave counts for only 8 or 9 *P. furcifer* (apparently the 3 specimens from the Galapagos and 6 from Bermuda listed in his Table 2 of measurements for *P. furcifer*; and he gave no indication that he analysed meristic data from any of the numerous specimens that he listed as having examined, other than the 9 specimens mentioned above. Our counts from 10 *P. furcifer* and 112 *P. colonus* show significant differences in the mean number of dorsal- and anal-fin rays for these two species (see key below). Johnson and Keener (1984) compared the configuration of the spinlets on the elongated second dorsal- and pelvic-fin spines of the larvae of Atlantic and Pacific specimens and found notable differences that “seem to offer morphological evidence for taxonomic separation of the Atlantic and Pacific populations of *P. furcifer*.”

There are slight differences in some meristic and morphometric characters between the populations of *P. colonus* at the Galapagos, American mainland, and Clipperton Island. But, in view of the considerable overlap in the ranges of all these characters, we have decided not to recognize these populations as distinct subspecies.

Key to the Species of *Paranthias*

1a. Dorsal-fin rays 17 to 19 (usually 18); anal-fin rays 8 to 10 (usually 9) (Fig. 486; Plate XXIX) (Atlantic Ocean) . . . . *P. furcifer*

1b. Dorsal-fin rays 18 to 21 (usually 19 or 20); anal-fin rays 9 to 11 (mean 10) (Fig. 487) (Eastern Pacific Ocean) . . . . *P. colonus*

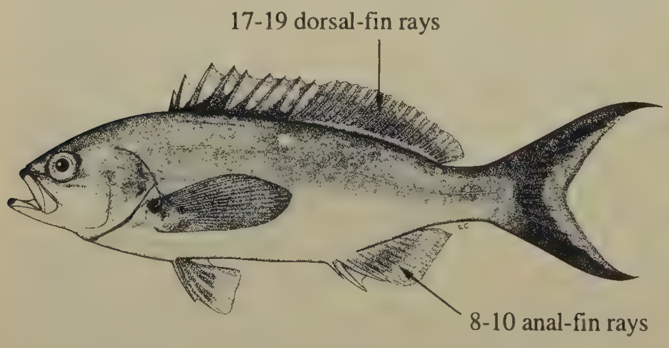


Fig. 486 *Paranthias furcifer*

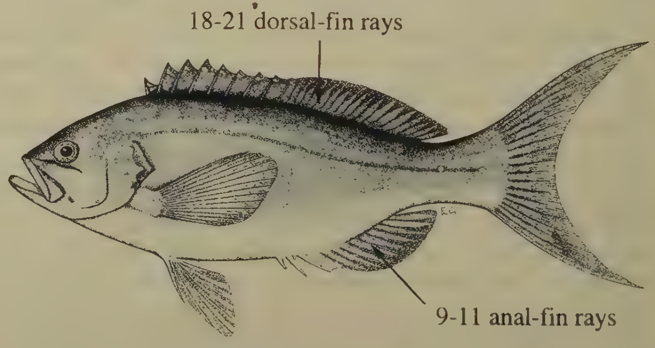


Fig. 487 *Paranthias colonus*

Paranthias colonus (Valenciennes, 1855) Fig. 488 SERRAN Parant 2

Serranus colonus Valenciennes, 1855:300, pl. 2, fig. 1 (type locality: Galapagos).

Synonyms: *Paranthias pinguis* Walford, 1936:2 (type locality: Guayamas, Mexico).

FAO Names: **En** - Pacific creole-fish; **Fr** - Badèche du Pacifique; **Sp** - Indio.

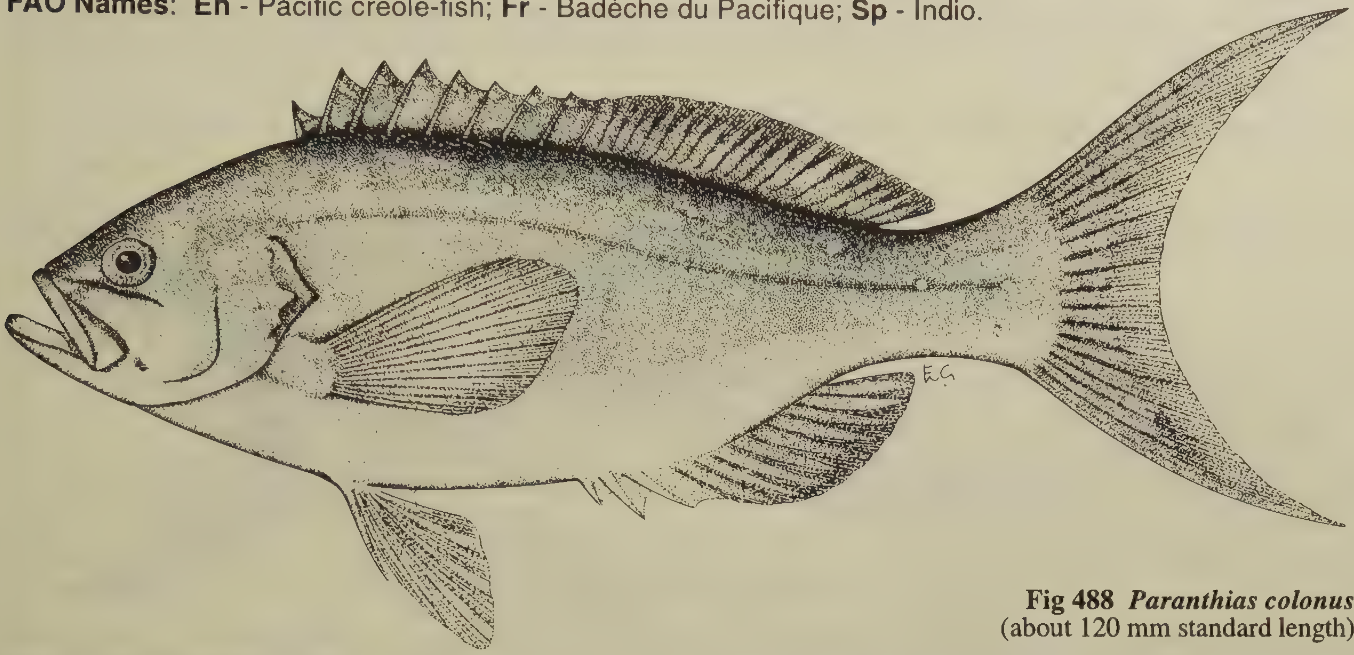


Fig 488 *Paranthias colonus*
(about 120 mm standard length)

Diagnostic Features: Body depth contained 2.9 to 3.4 times in standard length (for fish 11 to 30 cm standard length). Head length contained 3.2 to 4.0 times in standard length; interorbital area convex; preopercle subangular, with a shallow notch, the vertical edge and rear half of lower edge finely serrate; nostrils subequal. Gill rakers 12 to 15 on upper limb, 24 to 29 on lower limb, total 37 to 44. Dorsal fin with IX spines and 18 to 21 rays, the interspinous membranes indented; anal fin with III spines and 9 to 11 rays; pectoral-fin rays 19 to 23; caudal fin deeply forked. Midlateral-body scales ctenoid; lateral-line scales 68 to 86; lateral-scale series 95 to 146. **Colour**: Reddish or reddish grey, with 2 or 3 bright blue or violet spots on dorsal part of body and another 2 on midlateral part of caudal peduncle; pectoral-fin axil with a bright blue spot; dorsal-fin base dark, the fin margin reddish green. Some fish with 2 blue lines on cheek, one approximately horizontal and tangent to lower edge of eye, the other along upper edge of maxilla and continued onto lower part of cheek. Juveniles pinkish yellow, with bright blue dorsal spots.

Geographical Distribution: Eastern Pacific from the Gulf of California to Peru; also at the Revillagigedo, Galapagos, Clipperton, Cocos, and Malpelo islands (Fig. 489).

Habitat and Biology: See account of the genus above.

Size: Attains at least 30 cm standard length.

Interest to Fisheries: *P. colonus* (identified as "*Paranthias furcifer*") was said to be abundant in the Galapagos (Snodgrass and Heller, 1905).

Local Names:

Literature: Hildebrand (1946, in part). Identified as *Paranthias furcifer*: Snodgrass and Heller (1905); Smith (1971); Thomson et al. (1979).

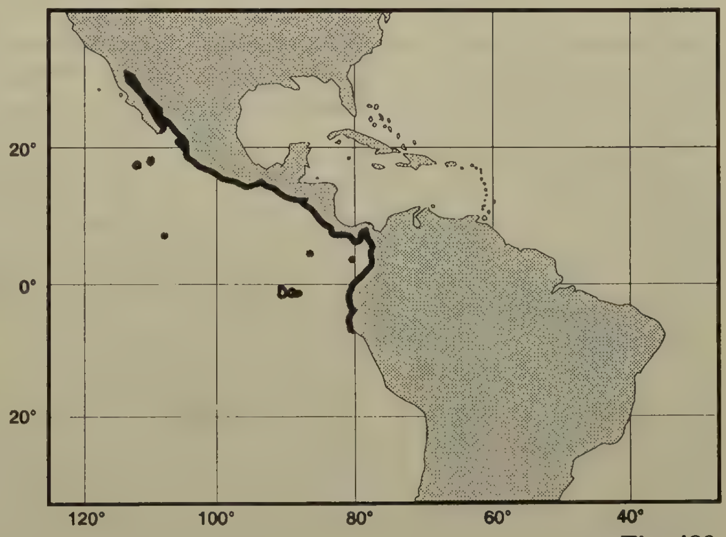


Fig. 489

Remarks: Kendall (1979) described and illustrated an 8.6 mm *Paranthias* larva from the eastern Pacific (SSE of the tip of Baja California). Johnson and Keener (1984) illustrated the second dorsal- and pelvic-fin spines of this specimen and remarked that it had a "notably different spinelet configuration" (compared with Atlantic specimens of *P. furcifer*).

Paranthias furcifer (Valenciennes, 1828)

Fig. 490; Pl. XXIXA

SERRAN Parant 1

Serranus furcifer Valenciennes in Cuv. and Val., 1828:264 (type locality: Brazil).

Synonyms: *Serranus creolus* Valenciennes in Cuv. and Val., 1828:265 (type localities, Haiti, Dominican Republic, Martinique). *Corvina oxyptera* DeKay, 1842:77, pl. 30, fig. 96 (type locality: "New York"). *Centropristes nebulosus* Castelnau, 1855:5, pl. 1, fig. 4 (type locality: Rio de Janeiro). *Serranus castelnaui* Jordan and Eigenmann, 1890:409 (type locality: Rio de Janeiro; replacement for *Centropristes nebulosus*, preoccupied in *Serranus*).

FAO Names: **En** - Creole-fish; **Fr** - Badèche créole; **Sp** - Cuna lucero.

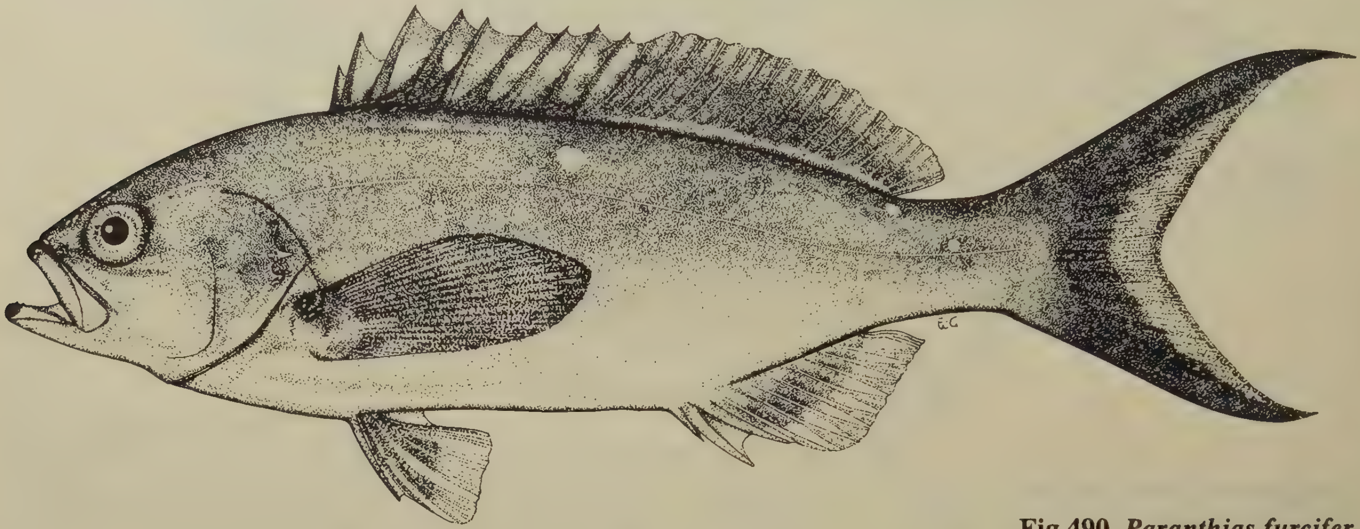


Fig 490 *Paranthias furcifer* (191 mm standard length)

Diagnostic Features: Body depth greater than head length, depth contained 2.9 to 3.4 times in standard length (for fish 19 to 28 cm standard length). Head length contained 3.5 to 3.8 times in standard length; preopercle subangular, the vertical edge and rear half of lower edge finely serrate; nostrils subequal. Gill rakers 12 to 14 on upper limb, 24 to 26 on lower limb, total 38. Dorsal fin with IX spines and 17 to 19 (rarely 19) rays, the interspinous membranes slightly indented; length of dorsal-fin base 56 to 58% of standard length; anal fin with III spines and 8 to 10 (rarely 10) rays; anal-fin base 16 to 19% of standard length; pectoral-fin rays 19 or 20; caudal fin deeply forked. Midlateral-body scales ctenoid; lateral-line scales 69 to 77; lateral-scale series 124 to 129. **Colour**: Head and body reddish brown, paler ventrally; bright orange-red spot at upper end of pectoral-fin base; 3 widely-spaced white spots between lateral line and dorsal-fin base; 2 blue lines on cheek, one approximately horizontal and tangent to lower edge of eye, the other along upper edge of maxilla and continued onto lower part of cheek; yellow-green spot on each interspinous dorsal-fin membrane and continued on soft-rayed part of fin as a dark green submarginal line.

Geographical Distribution: Tropical and subtropical waters of the Atlantic Ocean. In the eastern Atlantic, *P. furcifer* has been reported from Ascension Island (Lubbock, 1980), and the Gulf of Guinea islands of Principe, São Tomé, and Annobon (Osorio, 1893). In the western Atlantic, it is known from Bermuda, Florida, Gulf of Mexico, Campeche Bank, and throughout the Caribbean (except absent in the northern Bahamas) to São Paulo Brazil (Fig. 491).

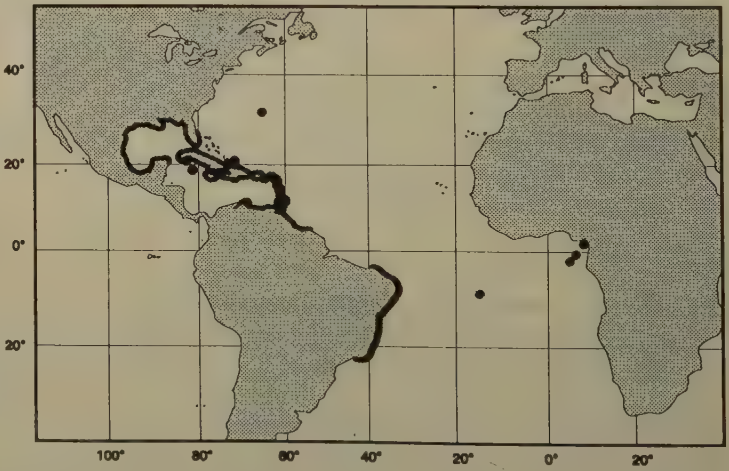


Fig. 491

Habitat and Biology: *P. furcifer* is known from coral reefs and hard bottom areas in depths of 10 to 64 m. Randall (1967) observed *P. furcifer* in feeding aggregations well above the reef. He examined the stomach contents of 13 specimens, 162 to 198 mm standard length. The principal food items were zooplankton: copepods (62%), pelagic tunicates (12%), shrimps and shrimp larvae (12%). Bullock and Smith (1991) listed histological evidence for protogyny in *Paranthias furcifer*, but they did not find any sexually transitional fish. C.L. Smith (1958) found ripe specimens on May 31st at Bermuda. Thompson and Munro (1983) reported ripe fish in January and March at the Jamaican Banks. Bullock and Smith (1991) found ripe specimens at the Florida Middle Ground from April to October. Batch fecundity estimates for two females (218 and 289 mm standard length) were 177 378 and 640 066 oocytes respectively.

Size: Maximum about 35 cm fork length.

Interest to Fisheries: Because of its small size, ***P. furcifer*** is not of much interest as a food fish, but it is commonly used for bait. According to Cervigón (1966), ***P. furcifer*** is usually caught with traps, which is unexpected for a fish that feeds on zooplankton.

Local Names: BERMUDA: Barber; VENEZUELA: Cunaro de piedra.

Literature: Smith (1971); Dennis and Bright (1988); Heemstra (1991).

Remarks: Johnson and Keener (1984) illustrated the second dorsal- and pelvic-fin spines and found that Atlantic specimens (***P. furcifer***) differed notably in spinelet configuration from Pacific specimens (here recognized as ***P. colonus***).

Plectropomus Oken, 1817

SERRAN Plect

Plectropomus Oken, 1817:1182 (page number misprinted as 1781); type species, ***Bodianus maculatus*** Bloch, by subsequent designation of Jordan, Tanaka and Snyder, 1913.

Synonyms: ***Plectropoma*** Quoy and Gaimard, 1824:318; type species, ***Plectropoma punctatum*** Quoy and Gaimard, 1824 by monotypy. ***Paracanthistius*** Bleeker, 1874:13; type species, ***Plectropoma leopardinus*** Cuvier (= ***Holocentrus leopardus*** Lacepède) by original designation. ***Pleuroperca*** Fowler and Bean, 1930:195, 201; type species, ***Plectropoma oligacanthus*** Bleeker, by original designation; proposed as a subgenus.

Diagnostic Features: Body robust, elongate, the depth less than head length and contained 2.9 to 3.9 times in standard length; body width contained 1.6 to 2.1 times in its depth. Head length contained 2.8 to 3.2 times in standard length; snout distinctly longer than eye diameter, snout length 2.8 to 3.6 times in head length; preorbital depth contained 5.6 to 10 times in head length; interorbital area concave or flat, the dorsal head profile convex; preopercle broadly rounded, with 3 large, ventrally directed spines (hidden by skin) along lower half; lower part of dorsal half of preopercle finely serrate; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils set in a shallow groove running forward from eye, the openings subequal or rear nostrils notably larger; lower jaw projecting; maxilla reaches to or beyond vertical at centre of eye; supramaxilla present; no bony knob or step on ventral edge of maxilla; a pair of stout curved canines at front of jaws; midlateral part of lower jaw with 1 to 4 enlarged, fixed canines; 2 or 3 rows of long slender depressible teeth along front half of jaws, shortening to a band of villiform teeth posteriorly; vomer and palatines with a narrow band of villiform teeth. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the fin membranes distinctly incised between the spines, the third or fourth spine usually longest, its length contained 3.2 to 4.2 times in head length and distinctly shorter than the longest dorsal-fin ray; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral fins short and rounded, with 14 to 18 rays, the middle rays longest, pectoral-fin length contained 1.7 to 2.4 times in head length; flap of skin joining base of upper pectoral-fin rays to body rudimentary or absent; pelvic fins subequal to pectoral fins; caudal fin truncate, emarginate, or concave, with 7 branched rays in upper part and 6 branched rays in lower part. Scales weakly ctenoid or smooth; auxiliary scales present. A single supraneural bone, the distal end more or less expanded, located above and anterior to tip of first neural spine; epipleural ribs on first 8 or 9 vertebrae; 1 or 2 trisegmental pterygiophores at rear end of dorsal and anal fins; cranium high posteriorly, the frontals inclined at an angle of about 40° to the parasphenoid; greatest width of cranium contained about 0.5 times in its length; least interorbital width of frontals contained about 0.5 times in postorbital width of frontals; parietal crests well developed, but not extending onto frontals; dorsal edge of supraoccipital crest subhorizontal. Characters of the larvae (Leis, 1986): Pelvic-fin spines with 3 ridges; no dorsal-fin spine develops first as a soft-ray and all are present on larvae of 7.7 mm; anal-fin spine development completed only after settlement (larger than 22 mm standard length); supraocular ridge with 2 to 4 weak spinules; spines on lower limb of preopercle not serrate.

Habitat and Biology: ***Plectropomus*** species are large (some species reaching at least 1 m total length) coral-reef fishes that occur in shallow tropical and subtropical waters. Like most ***Mycteroperca*** species (their ecological equivalents in Atlantic and eastern Pacific waters), ***Plectropomus*** are less sedentary than species of ***Epinephelus*** or ***Cephalopholis***, and they are primarily piscivorous.

Geographical Distribution: The genus ***Plectropomus*** is confined to the Indo-Pacific region.

Interest to Fisheries: ***Plectropomus*** species are of considerable importance to artisanal fisheries, but they are often the cause of ciguatera fish poisonings (Randall, 1980). They are caught with hook-and-line, spear, and in fish traps.

Species: Randall and Hoese (1986) revised the genus and recognized 7 species.

Remarks: Leis (1986) discussed the phylogenetic relationships of ***Plectropomus*** based on his comparison of the larval development in four species with that of other known epinepheline larvae. He suggested that ***Plectropomus*** is the primitive sister group of all of the other epinepheline genera for which larvae are known (i.e., ***Gonioplectrus***, ***Cephalopholis***, ***Mycteroperca***, ***Epinephelus*** [including ***Alphestes*** and ***Dermatolepis*** as subgenera of ***Epinephelus***]), and ***Paranthias***. Although Leis mentioned (p. 528) that the monotypic genus ***Saloptia*** "is closely related to and perhaps synonymous with ***Plectropomus*** ...," he did not explain this hypothesis, except to note that these two genera are the only epinepheline species with a single supraneural (predorsal) bone and a dorsal fin with VIII spines and 11 rays. Two additional characters shared by ***Saloptia*** and ***Plectropomus*** (not mentioned by Leis) that may indicate a close phylogenetic relationship of these two genera are the large antrorse spines on the lower edge of the preopercle and the reduced number of branched caudal-fin rays (13, versus 15 in other epinephelines). But the polarity of these latter two characters is unclear. ***Niphon***, ***Dicentrarchus***, and several anthiines also have 3 large antrorse spines on the lower edge of the preopercle; and several anthiines also have only 13 branched caudal-fin rays. We agree with Leis (1986) and J.L.B. Smith (1963) that ***Plectropomus*** and ***Saloptia*** are closely related (sister groups).

Johnson (1988) criticized Leis' polarization of certain characters, but he did not question Leis' hypothesis of ***Plectropomus*** as the primitive sister group of the five other grouper genera for which the larvae are known.

Key to the Species of *Plectropomus*

1a. Anterior rays of soft dorsal and anal fins elevated, the fin margin with a distinct lobe anteriorly; longest dorsal-fin ray 1.5 to 2.1 times in head length; pectoral-fin rays 14 to 16; adults with vertical blue lines anteriorly on side of body and head (Fig. 492, Plate XXX) (Philippines and East Indies) . . . . *P. oligacanthus*

1b. Anterior rays of dorsal and anal fins not elevated to form a lobe; longest dorsal-fin ray 2.2 to 3.2 times in head length; pectoral-fin rays 15 to 18; adults not coloured as in 1a . . . . → *2*

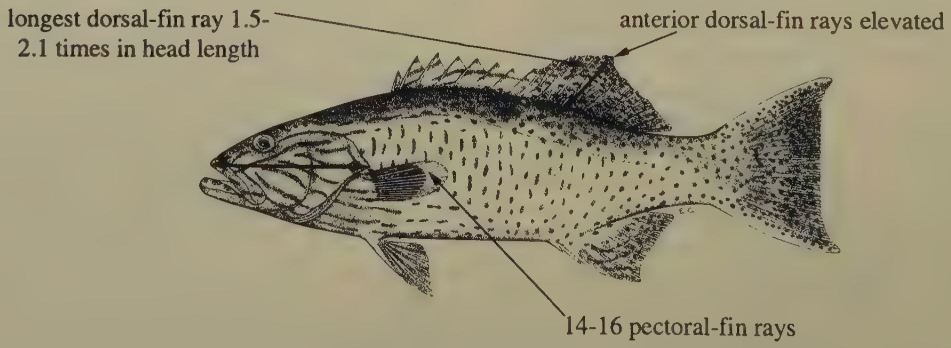

longest dorsal-fin ray 1.5-2.1 times in head length
anterior dorsal-fin rays elevated
14-16 pectoral-fin rays

Fig. 492 *Plectropomus oligacanthus*

2a. Body uniform brown or brown marbled with olive green, brownish orange or white; juveniles brownish with pale horizontally elongate spots and streaks; pectoral-fin rays 16 to 18 (Fig. 493, Plates XXX and XXXI) (western Indian Ocean) . . . . *P. punctatus*

2b. Body with numerous blue spots or with saddle-like black bars and blotches and a few blue spots; pectoral-fin rays 15 to 18 . . . . → *3*

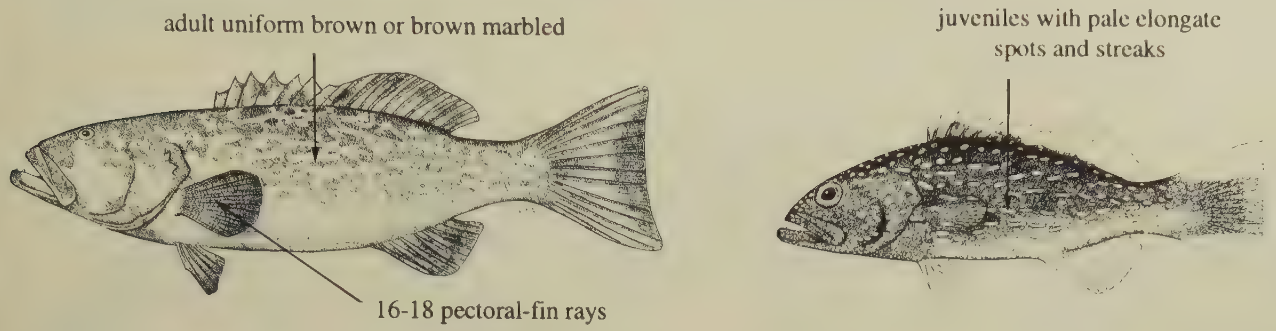

adult uniform brown or brown marbled
juveniles with pale elongate spots and streaks
16-18 pectoral-fin rays

Fig. 493 ***Plectropomus punctatus***

3a. Caudal fin truncate to slightly emarginate, the caudal concavity (difference between lengths of longest [upper] ray and shortest [middle] rays) more than 13 times in head length; interorbital area with small embedded scales; head, body (including ventral parts) and median fins covered with close-set, round to slightly oval, dark-edged blue spots; distance between spots subequal to spot diameters; developed gill rakers on lower limb of first gill arch 2 to 7 (Fig. 494, Plate XXIX) (Red Sea to central Pacific) . . . . *P. areolatus*

3b. Caudal fin emarginate, the caudal concavity 5 to 12 times in head length; no scales on interorbital area; blue spots round to oblong; lower developed gill rakers 4 to 10 . . . . → *4*

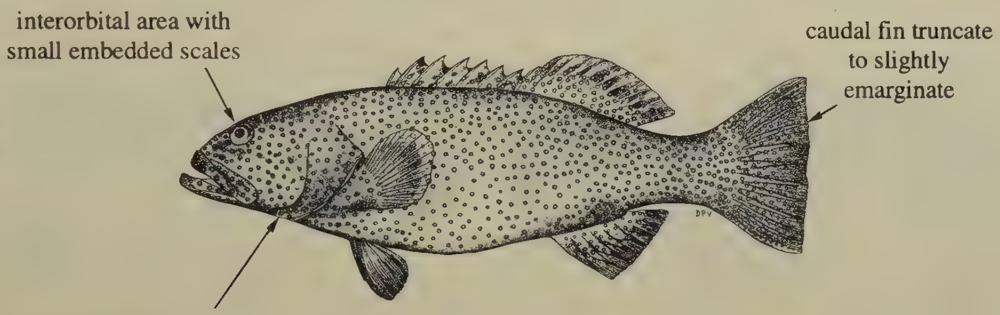

interorbital area with small embedded scales
caudal fin truncate to slightly emarginate
DPV
2-7 developed gill rakers on lower limb

Fig. 494 ***Plectropomus areolatus***

4a. Pectoral-fin rays 16 to 18; caudal-fin length 1.5 to 1.8 times in head length; pectoral-fin and pelvic-fin length 2.1 to 2.4 times in head length; head and body pale, with large saddle-like dark brown or black bars and a few small blue spots, the fins yellow; or head and body brownish with numerous small blue spots and with or without faint dark bars (Fig. 495, Plate XXIX) (Indo-Pacific) . . . . *P. laevis*

4b. Pectoral-fin rays 15 to 17; caudal-fin length 1.3 to 1.5 times in head length; pectoral-fin and pelvic-fin length 1.7 to 2.3 times in head length; no broad dark saddle-like bars on body . . . . . → *5*

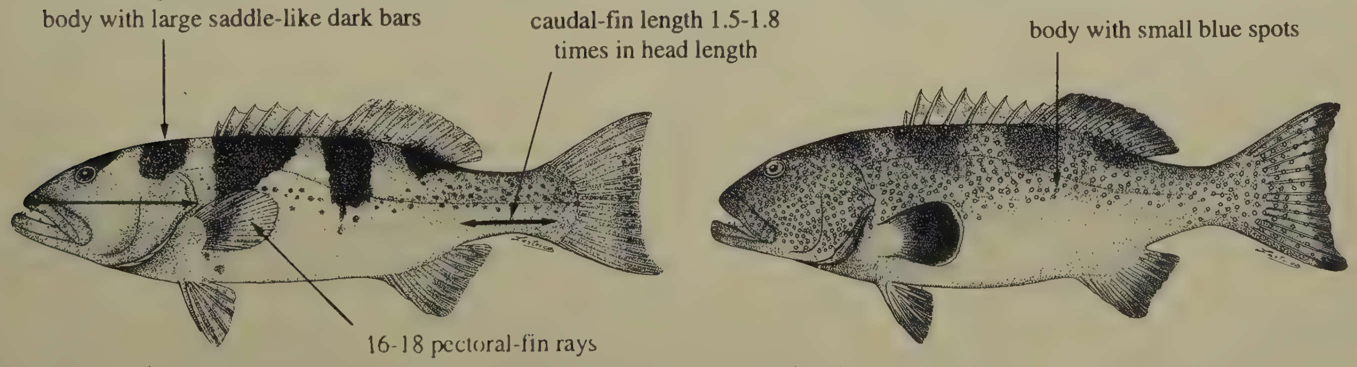

body with large saddle-like dark bars
caudal-fin length 1.5-1.8 times in head length
body with small blue spots
16-18 pectoral-fin rays

Fig. 495 ***Plectropomus laevis***

5a. Head and body covered (except ventrally) with minute round blue spots, which are about the size of the nostrils, the distance between the spots more than twice their diameter; median fins also covered with blue spots (Fig. 496, Plate XXIX) (Western Australia and western Pacific) . . . . *P. leopardus*

5b. Most blue spots on head and body more than twice the size of nostrils; some spots on head and body elongate (except juveniles) . . . . → *6*

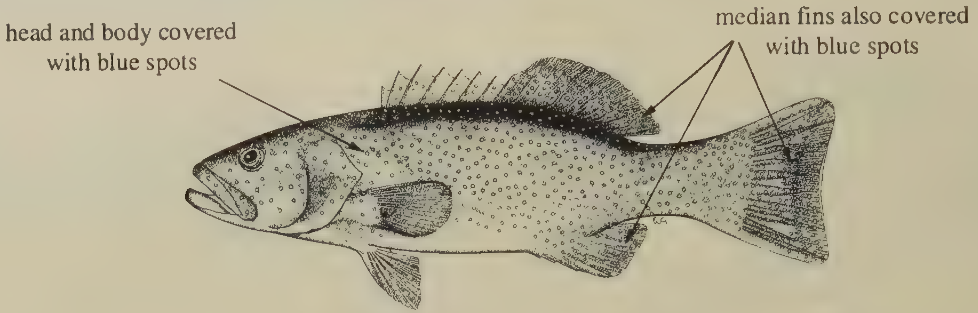

head and body covered with blue spots
median fins also covered with blue spots

Fig. 496 ***Plectropomus leopardus***

6a. Pelvic fins without blue spots; some spots on body of adults horizontally elongate; gill raker at angle of first gill arch longer than longest gill filament; pelvic-fin length 1.7 to 2.1 times in head length; nostrils subequal (Fig. 497, Plate XXIX) (Philippines to Australia). . . . . . . *P. maculatus*

6b. Pelvic fins with blue spots; some spots on body of adults vertically elongate; gill raker at angle of first gill arch shorter than longest gill filaments; pelvic-fin length 1.9 to 2.3 times in head length; rear nostrils of adults over 40 cm standard length distinctly larger than anterior nostrils (Fig. 498, Plate XXX) (Red Sea to Fiji) . . . . *P. pessuliferus*

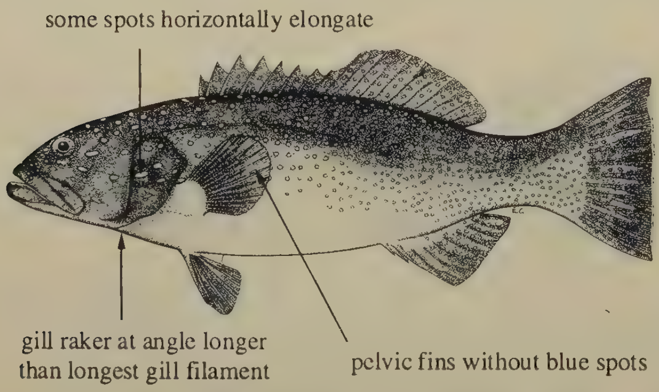

some spots horizontally elongate
gill raker at angle longer than longest gill filament
pelvic fins without blue spots

Fig. 497 ***Plectropomus maculatus***

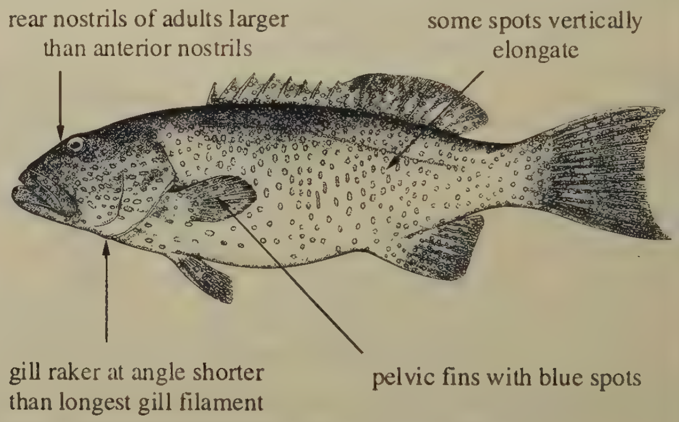

rear nostrils of adults larger than anterior nostrils
some spots vertically elongate
gill raker at angle shorter than longest gill filament
pelvic fins with blue spots

Fig. 498 ***Plectropomus pessuliferus***

Plectropomus areolatus Rüppell, 1830

Fig. 499; Pl. XXIXB

SERRAN Plect 2

Plectropoma areolatum Rüppell, 1830: footnote on page 2 of index (type locality: Mohila, Red Sea).

Synonyms: ***Plectropoma maculatum***? (non Bloch): Rüppell, 1830:110 (Mohila, Red Sea; authorship attributed to Cuvier). ***Plectropomus truncatus*** Fowler and Bean, 1930:195, 196, fig. 5 (type locality: Atulayan Island, Lagonoy Gulf, east coast of Luzon).

FAO Names: **En** - Squaretail coralgrouper (formerly: Squaretail coraltrout); **Fr** - Mérou queue carrée; **Sp** - Mero troncón.

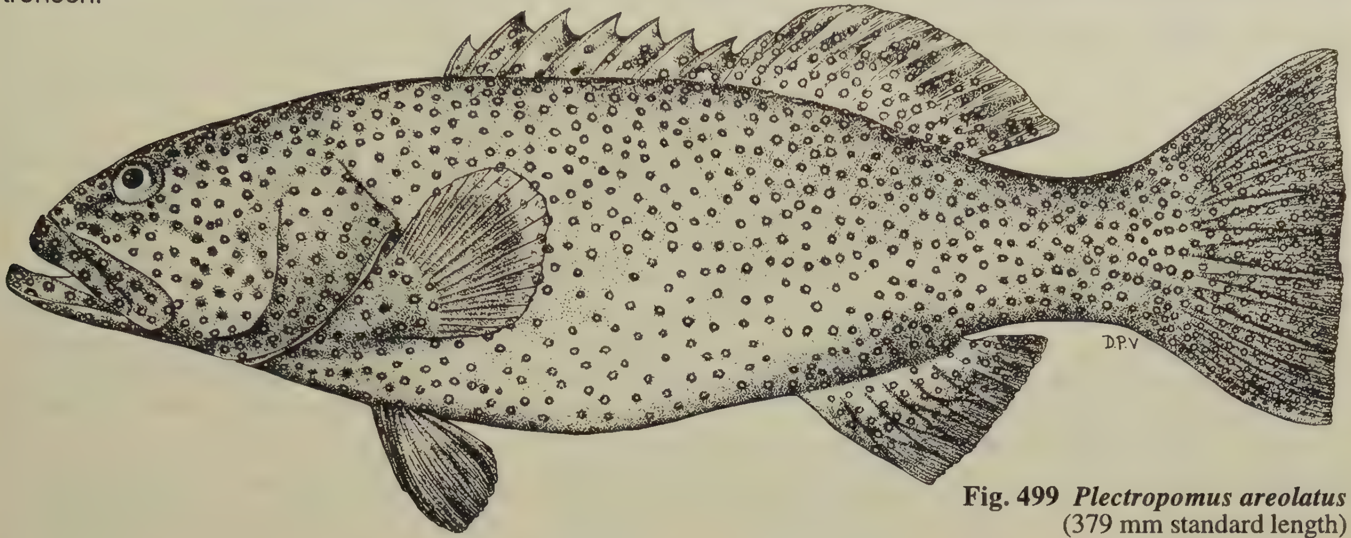


Fig. 499 ***Plectropomus areolatus***
(379 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 15 to 48 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), with small, embedded scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils subequal, set in a shallow groove running forward from eye; midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Lower limb developed gill rakers 2 to 7, gill raker at angle shorter than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest ray contained 2.3 to 2.6 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral-fin rays 15 or 16; pectoral fins subequal to pelvic fins, pectoral-fin length contained 2.0 to 2.4 times in head length; caudal fin truncate to slightly emarginate, the caudal concavity contained more than 13 times in head length. Lateral-line scales 83 to 97. **Colour**: Head, body, and median fins greenish grey to brown or brownish red, with numerous round to oval dark-edged blue spots (the largest about equal to pupil); most spots within a spot diameter of adjacent spots; pelvic fins with dark brown to blackish membranes; rear margin of caudal fin with a white edge and often with a blackish submarginal band.

Geographical Distribution: Indo-Pacific; except for the Red Sea and Australia, records of *P. areolatus* are limited to insular localities: Chagos, Maldives, Cocos-Keeling Islands, Rowley Shoals (Western Australia), Indonesia, Philippines, Taiwan, Ryukyu Islands, Paracel Islands (South China Sea), Palau Islands, Great Barrier Reef, Caroline Islands, Marshall Islands, Samoa Islands, and the Phoenix Islands (Fig. 500).

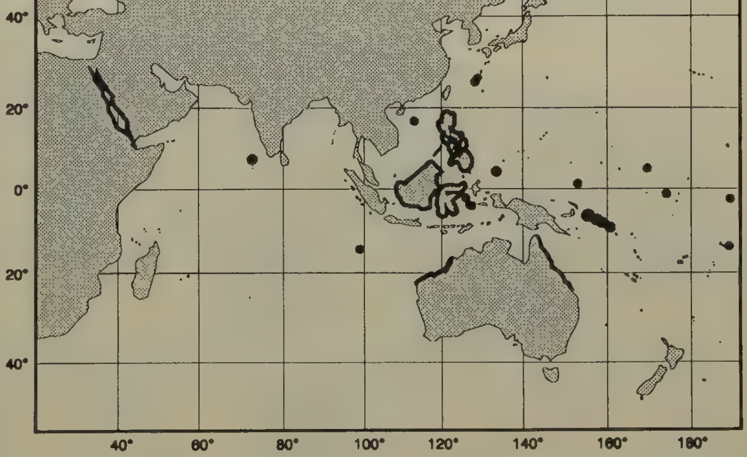


Fig. 500

Habitat and Biology: *P. areolatus* is shy and difficult for a diver to approach. It is found in lagoons and on the outer reef at depths of 2 to 20 m. Hiatt and Strasburg (1960) reported a squirrelfish from the stomach of one specimen. According to Myers (1989): "For a few days before new moon in May, large numbers gather in the seaward end of Ulong Channel, Belau to spawn. At this time, males may display light bodies with about five irregular dark saddles and dark dorsal and anal fins."

Size: Attains at least 60 cm standard length (1 m standard length according to Katayama, 1988).

Interest to Fisheries: Undoubtedly of interest to artisanal fisheries, but no statistics are available for *P. areolatus*. Caught with hook-and-line.

Local Names: JAPAN: O-aonome-ara; MICRONESIA: Squaretail coral trout; SAMOA: Ata'ata-utu.

Literature: Randall and Hoese (1986); Randall and Heemstra (1991).

Remarks: Leis (1986) gave some descriptive information on the larvae.

Plectropomus laevis (Lacepède, 1801)

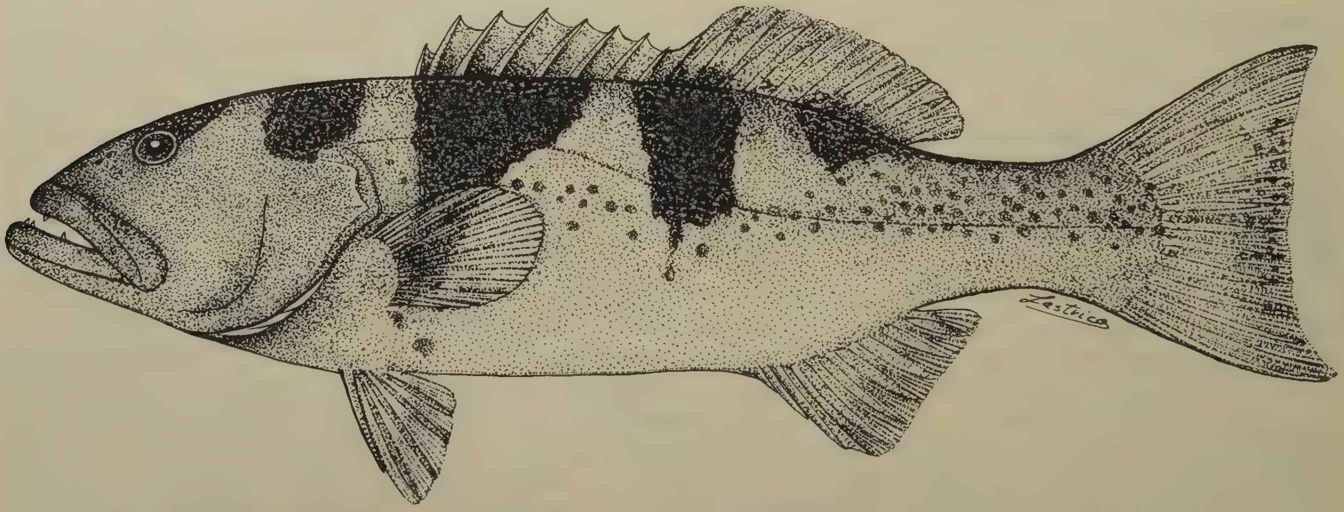
Fig. 501; Pl. XXIXC,D

SERRAN Plect 3

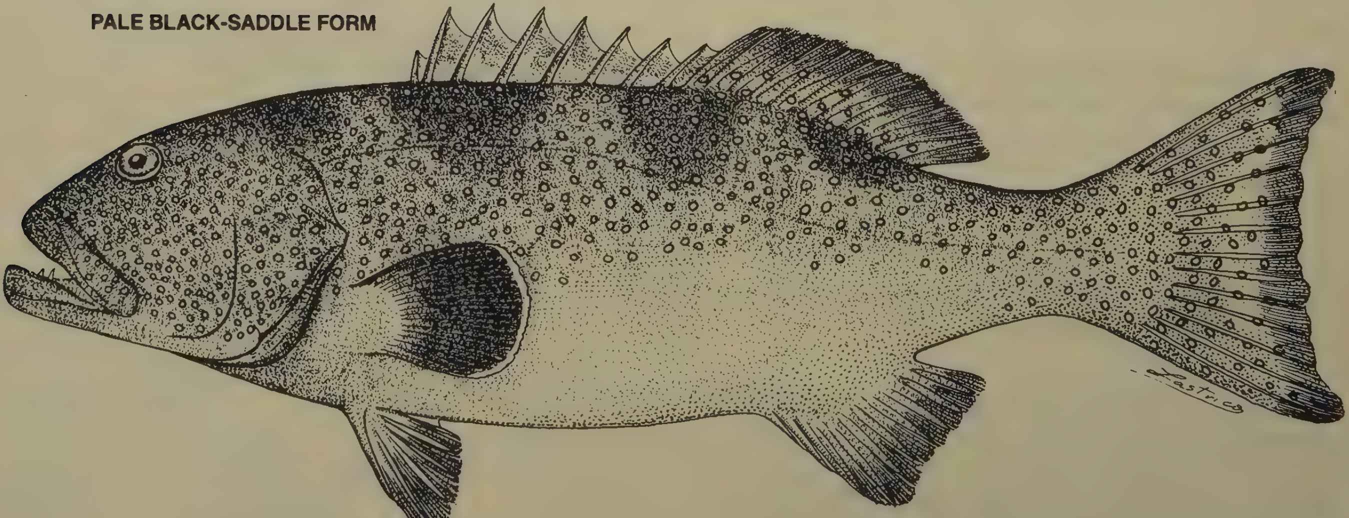
Labrus laevis Lacepède, 1801:431, 477, pl. 23, fig. 2 (type locality: Indian Ocean).

Synonyms: ***Bodianus cyclostomus*** Lacepède, 1802:282, 293 (1801:pl. 20, fig. 3, labelled "Bodian Cyclostòme"; no locality given). ***Bodianus melanoleucus*** Lacepède, 1802:283, 296 (type locality: Mauritius). ***Plectropoma maculatum*** varieties A to C Playfair in Playfair and Günther, 1867:13 (Zanzibar). ***Plectropoma maculatum*** varieties C and D: Boulenger, 1895:161 to 162 (Zanzibar, Mauritius, Sri Lanka, and Palau Islands). Often misidentified as "***Plectropomus maculatus***."

FAO Names: **En** - Blacksaddled coralgrouper (formerly: Blacksaddled coraltrout); **Fr** - Mérou sellé; **Sp** - Mero ensillado.



PALE BLACK-SADDLE FORM



DARK FORM

Fig. 501 ***Plectropomus laevis***
(pale black-saddle form 492 mm standard length, dark form 475 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 11 to 62 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils subequal, set in a shallow groove running forward from eye; midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Lower limb developed gill rakers 4 to 10, gill raker at angle shorter than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest dorsal-fin ray contained 2.3 to 3.3 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral-fin rays 16 to 18; pectoral fins subequal to pelvic fins, pectoral-fin length contained 2.1 to 2.4 times in head length; caudal fin emarginate, the caudal concavity contained 5 to 10 times in head length. Lateral-line scales 83 to 97. **Colour**: Two colour forms: the pale black-saddled form is whitish or pale yellowish with 5 dark brown to black, irregular, saddle-like or wedge-shaped bars or blotches on dorsal part of head and body, the first just behind eyes, the second on nape, the third to fifth under dorsal fin; small dark-edged blue spots may be visible on body (mainly posteriorly); fins, caudal peduncle, snout and jaws yellow; black blotch centrally at base of paired fins; small juveniles (7 to 15 cm standard length) with membranes between first and fifth dorsal-fin spines mostly blackish. The dark form is brown, olivaceous, red, or nearly black, the dark bars (as on pale form) are usually faint or absent; numerous, round, dark-edged blue spots (about half pupil diameter) on head, body (except ventrally), soft dorsal, caudal and anal fins, and base of pectoral fins; pectoral fins dark brown distally, the rays darker than membranes, the rear edge white.

Geographical Distribution: Indo-Pacific, from southern Mozambique to the Tuamotus, Austral Islands and Rapa, but not in the Red Sea or Persian Gulf. Except for the east coasts of Africa and Australia, records of *P. laevis* are from insular localities; it ranges from Kenya to Delagoa Bay and is known from most of the islands of the Indian Ocean. In the western Pacific, it occurs from Japan (Ryukyu Islands) to the southern Great Barrier Reef, and is known from most of the islands in the central and western Pacific (Fig. 502). *P. laevis* has not been recorded from the Asian coast or Indonesia.

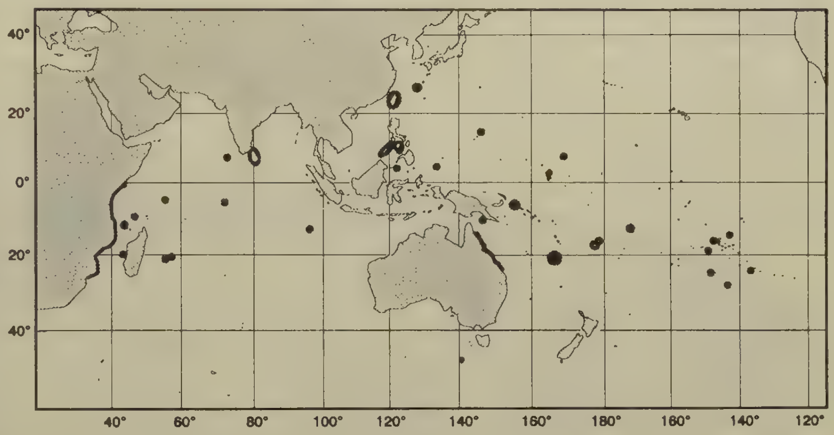


Fig. 502

Habitat and Biology: *P. laevis* is a conspicuous and fairly common species on coral reefs of the Indo-Pacific region at depths of 4 to at least 90 m. A.M. Ayling (quoted in Randall and Hoese, 1986) suggested that the pale black-saddled juveniles may be mimics of the pufferfish *Canthigaster valentini*: "... juveniles of both forms [pale and dark] less than about 20 cm total length normally employ pectoral fin sculling for propulsion, holding the caudal fin distinctly folded and the front section of the spinous dorsal erect. When swimming in this manner, individuals of *P. laevis* less than 12 cm total length look remarkably similar to the puffer fish *Canthigaster valentini* and may be mimicking this species."

It is interesting to note that the pale black-saddled form of *P. laevis* are usually smaller (8 to 57 cm standard length) than the dark reddish brown phase (15 to 100 cm standard length). It is tempting to speculate that these two colour phases represent sexual dichromatism with the smaller (pale phase) being juveniles and females, and the larger dark phase being males. We have no information on sex ratios for the two colour forms, but this hypothesis would agree with a protogynous hermaphroditism type of reproductive system, which seems to be the usual system for groupers and is known for *P. leopardus*. According to Morgans (1982) maturity "seems to occur" at 50 to 52 cm standard length (2.8 to 3.2 kg).

Randall (1980) and Morgans (1982) reported that *P. laevis* feeds exclusively on fishes. The prey comprises a variety of large reef fishes, including groupers. This diet of large fishes is responsible for the high concentrations of ciguatera toxins found in this species (Randall, 1980).

Size: Attains 100 cm standard length (about 125 cm total length) and a weight of 18 kg.

Interest to Fisheries: Despite the danger of ciguatera poisoning, ***P. laevis*** is commonly used for food. Caught with hook-and-line, spear, and in fish traps.

Local Names: AUSTRALIA: Coral trout, Chinese footballer, Footballer trout, Tiger trout; JAPAN: Kokuhanara; KENYA: Njombo; MICRONESIA: Saddleback grouper, Giant coraltrout; NEW CALEDONIA: Indépendante, Babonne, Saumonée grosse race; PHILIPPINES: Sunong-kabang (Visayan); TAHITI: Tonu; TANZANIA: Njombo.

Literature: Misidentified as ***P. maculatus***: Talbot (1959) and Morgans (1982). Randall and Hoese (1986); Myers (1989); Randall et al. (1990); Randall and Heemstra (1991).

Remarks: Leis (1986) gave some descriptive information on the larvae.

Plectropomus leopardus (Lacepède, 1802) Fig. 503; Pl. XXIXE SERRAN Plect 1

Holocentrus leopardus Lacepède, 1801:332, 367 (no locality given, but the holotype came from the East Indies, probably Indonesia).

Synonyms: ***Plectropoma leopardinus*** Cuvier in Cuv. and Val., 1828:392, pl. 36 (substitute for ***Holocentrus leopardus*** Lacepède). ***Plectropoma cyanostigma*** Bleeker, 1845:525 (*nomen nudum*; listed in synonymy of ***Paracanthistius leopardinus***). ***Plectropoma maculatum*** variety B Bleeker, 1849:40 (Jakarta). ***Paracanthistius suji*** Tanaka, 1916:415, pl. 112, fig. 3 (type locality: Saigasaki, Japan).

FAO Names: **En** - Leopard coralgrouper (formerly: Bluedotted coraltrout); **Fr** - Saumonée léopard (formerly: Mérou étoiles bleues); **Sp** - Mero celestrial.

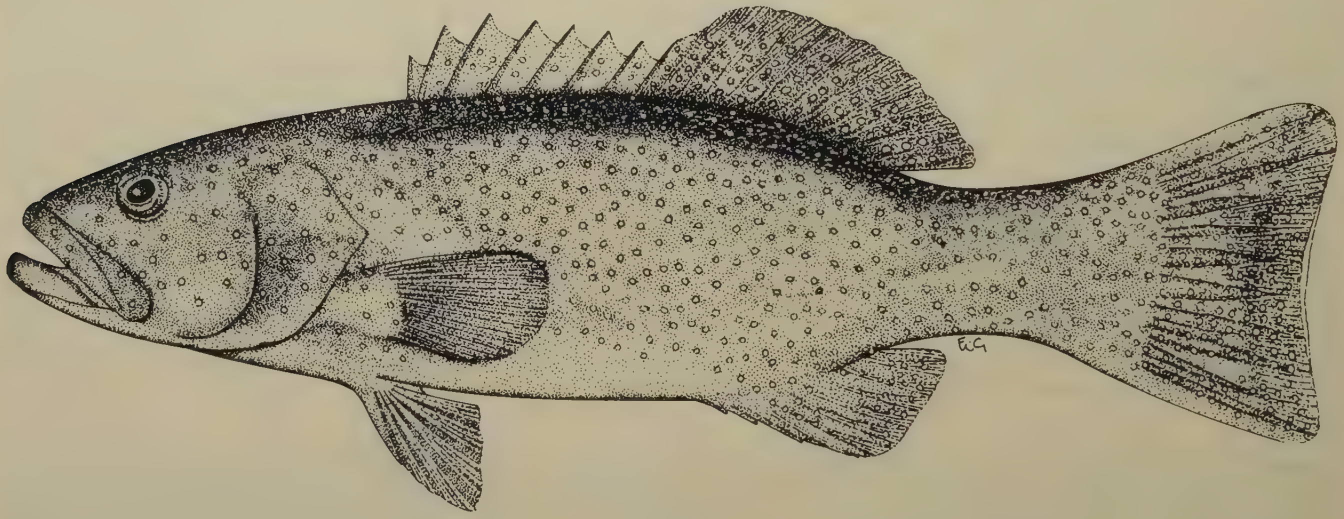


Fig. 503 ***Plectropomus leopardus***
(208 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 12 to 50 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils subequal for fish less than 40 cm standard length (at larger sizes, the rear nostrils may be enlarged); midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Lower limb developed gill rakers 6 to 10, gill raker at angle longer than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest dorsal-fin ray contained 2.2 to 2.7 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral-fin rays 15 to 17; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.9 to 2.2 times in head length; caudal fin emarginate, the caudal concavity contained 5 to 12 times in head length. Lateral-line scales 89 to 99. **Colour**: Olivaceous to reddish brown, orange-red or red, with numerous small (nostril sized and usually dark-edged) blue spots on head and body (except ventrally) and median fins; more than 10 spots on cheek (below and behind eye to rear edge of preopercle; blue ring (dark brown in alcohol) on edge of orbit (sometimes broken into segments);

pectoral fins reddish or hyaline with darker rays; an indistinct dark band at rear margin of caudal fin, with a white line usually visible along middle of rear edge of the fin.

Geographical Distribution: Western Pacific, from southern Japan to Australia (Queensland and Western Australia) and eastward to the Caroline Islands and Fiji. We have also examined specimens from Hong Kong, Viet Nam, Philippines, Indonesia, Palau Islands, Papua New Guinea, and New Caledonia (Fig. 504).

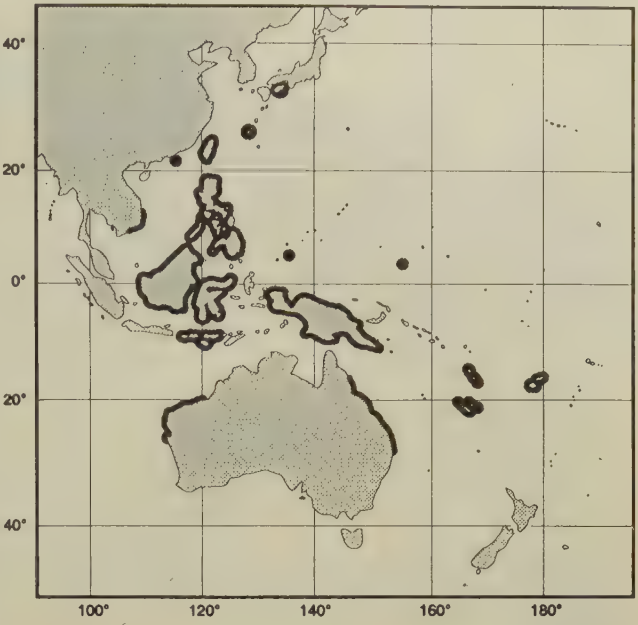


Fig. 504

Habitat and Biology: *P. leopardus* occurs on coral reefs of the Indo-Pacific region at depths of 3 to 100 m. Goeden (1978) studied age, growth and biology of *P. leopardus* from the Great Barrier Reef. Annual growth increments and age were determined from modal separation of length-frequency distributions. The largest fish (modal standard length of 50 cm) were estimated to be 5 years old. The species was found to be a protogynous hermaphrodite, based on histological evidence and the size versus sex distribution. The smallest mature female was 21 cm standard length (age 2) and the largest 47 cm (age 4); the smallest mature male was 30 cm (age 3) and the largest male was 54 cm. Spawning occurred in late November and early December. A 4-year old fish was estimated to contain 457 900 eggs. Goeden (1978) also described courtship behaviour of 2 males with 12 females: 1 or more hovering females were approached from behind by a larger male which changed from dark brown to pale brown or brownish white, while the margins of median fins remained conspicuously dark; as the male came close to the female, it began flicking its dorsal and pelvic fins, which elicited a mild lateral display from the female and the male then rolled onto its side and shook from side to side as its abdomen passed near the female. This procedure took about 15 seconds and was repeated 5 times; no release of milt or eggs was observed.

Goeden (1978) also found that *P. leopardus* feeds throughout the day and is inactive at night; 96% of the prey comprised fish. Small juveniles (6 to 20 cm standard length) included a few benthic crustaceans in their diet, but adults feed only on fishes, primarily atherinid and scarid fishes.

Size: Attains 57 cm standard length (about 70 cm total length).

Interest to Fisheries: *P. leopardus* is a popular food fish and sometimes causes ciguatera. Caught with hook-and-line, spear, traps, and trawls.

Local Names: AUSTRALIA: Coral trout; JAPAN: Suji-ara; MICRONESIA: Leopard coral trout; NEW CALEDONIA: Saumonée léopard; PHILIPPINES: Suno (Visayan), Mambo (Cuyonin); SAMOA: Ata'ata-utu; SINGAPORE: Kerapu bara; TAHITI: Tonu.

Literature: Often misidentified as *P. maculatus*: Fourmanoir and Laboute (1976); Min et al. (1982); Randall and Hoese (1986); Randall and Heemstra (1991).

Remarks: Leis (1986) described and illustrated the development of the larvae and a newly settled juvenile of 20 mm standard length.

Plectropomus maculatus (Bloch, 1790)

Fig. 505; Pl. XXIXF

SERRAN Plect 4

Bodianus maculatus Bloch, 1790:48, pl. 228 (type locality given as Japan, but probably an error for Java).

Synonyms: None.

FAO Names: **En** - Spotted coralgrouper (formerly: Spotted coraltrout); **Fr** - Vielle Saint-Silac; **Sp** - Mero con pintas (formerly: Mero de coral).

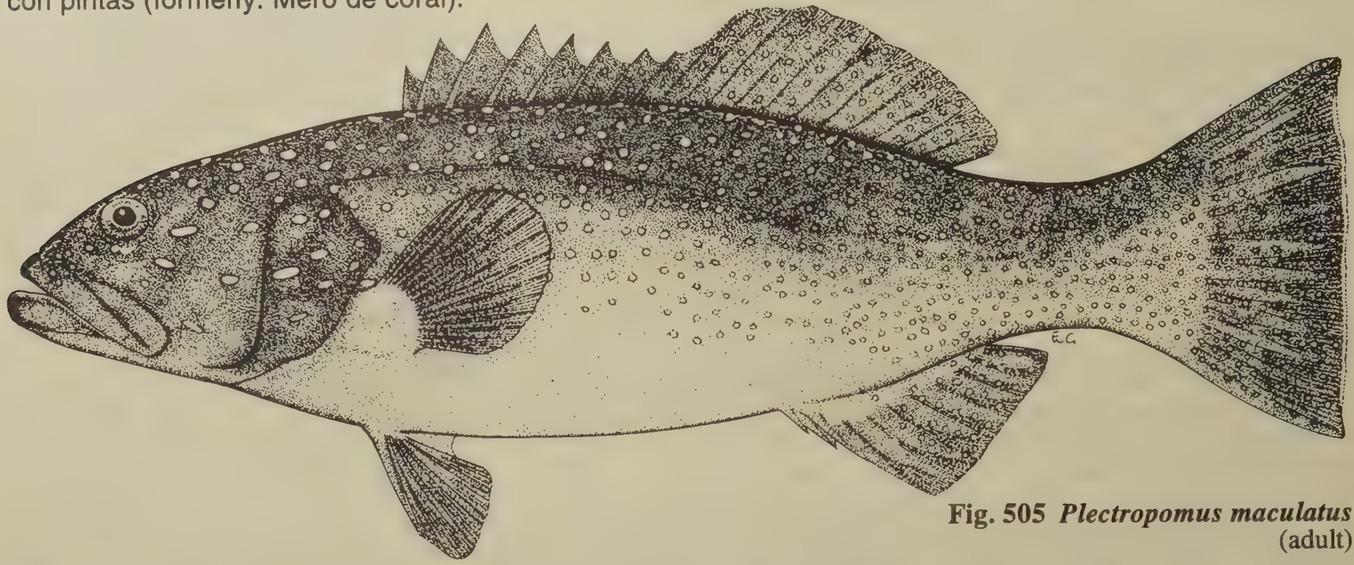


Fig. 505 ***Plectropomus maculatus*** (adult)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 15 to 48 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils subequal, set in a shallow groove running forward from eye; midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Developed gill rakers on lower limb 6 to 9, gill raker at angle distinctly longer than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest dorsal-fin ray contained 2.2 to 2.5 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral-fin rays 15 to 17; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.7 to 2.2 times in head length; caudal fin emarginate, the caudal concavity contained 5 to 10 times in head length. Lateral-line scales 83 to 97. **Colour**: Head, body, and median fins greenish grey, brown, red, or orange-red, with dark-edged blue spots; spots on head and anterior part of body about half pupil diameter or larger (and many are oval or horizontally elongated), becoming much smaller, more uniformly round, and more numerous on rear part of body and on fins; few spots on head, 3 to 7 on cheeks (below and behind eye to rear edge of preopercle); no blue spots on ventral parts of head and body; usually a single blue spot on pectoral-fin base and another in axil; no blue spots on pelvic fins; rear margin of caudal fin with a white edge.

Geographical Distribution: *P. maculatus* is known only from the western tropical Pacific: Thailand, Singapore, Philippines, Indonesia, Papua New Guinea, Solomon Islands, and Australia (Western Australia to southern Queensland) (Fig. 506). *P. maculatus* was formerly listed for the western Indian Ocean (Heemstra and Randall, 1984) due to a misidentification of *P. pessuliferus*.

Habitat and Biology: *P. maculatus* is common on coastal reefs of Queensland and Indonesia. Depths of capture for this species are 5 to 50 m.

Size: Attains 100 cm standard length (about 125 cm total length) and a weight of 25 kg.

Interest to Fisheries: *P. maculatus* is commonly used for food. Caught with hook-and-line, spear, and in trawls.

Local Names: AUSTRALIA: Coral cod, Leopard fish, Coral trout, Leopard trout; MALAYSIA: Keapu bara; PAPUA NEW GUINEA: Bogi; SINGAPORE: Kerapu sonoh, Jĭn hou.

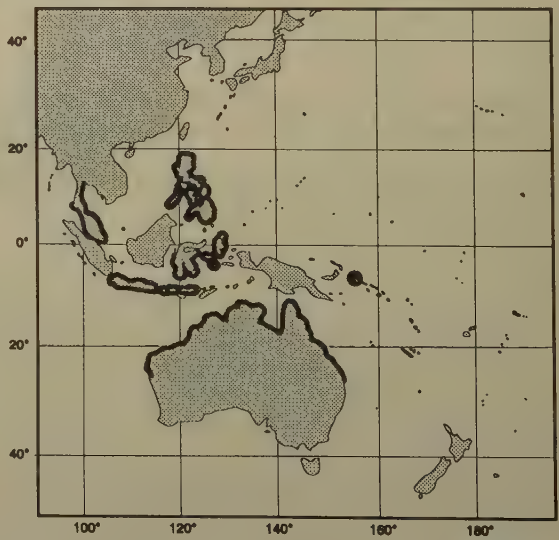


Fig. 506

Literature: Kyushin et al. (1982); Min et al. (1982); Randall and Hoese (1986); Randall and Heemstra (1991).

Remarks: Leis (1986) described and illustrated the larvae and a 40 mm juvenile.

Plectropomus oligacanthus Bleeker, 1854

Fig. 507; Pl. XXXA

SERRAN Plect 6

Plectropoma oligacanthus Bleeker, 1854:422 (type locality: Jakarta, Indonesia).

Synonyms: *Plectropoma variegatum* Castelnau, 1875:7 (type locality: Cape York, Australia).

FAO Names: **En** - Highfin coralgrouper; **Fr** - Mérou-loche cacatois; **Sp** - Mero vela.

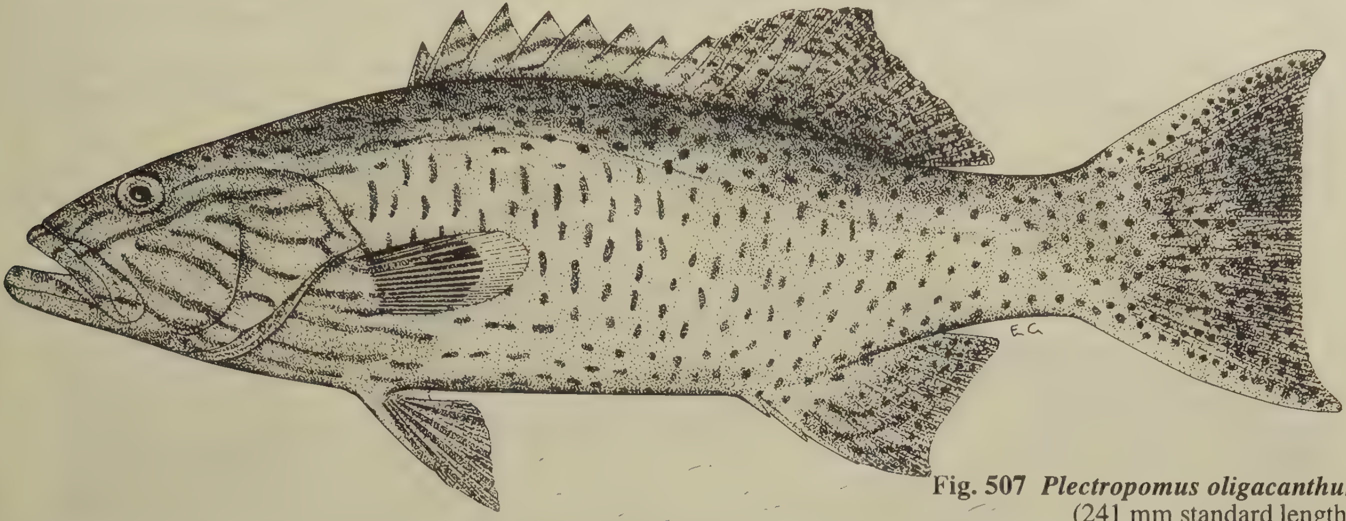


Fig. 507 *Plectropomus oligacanthus* (241 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 16 to 51 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 3.3 to 7.2 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Developed gill rakers on lower limb 7 to 9, gill raker at angle subequal to gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult see in large fish; soft dorsal and anal fins pointed anteriorly, the second to fourth dorsal- and anal-fin rays elongated, their length contained 1.5 to 2.1 times in head length; pectoral-fin rays 14 to 16; pectoral fins shorter than pelvic fins, pectoral-fin length contained 2.1 to 2.4 times in head length; caudal fin emarginate, the caudal concavity contained 3 to 7 times in head length. Lateral-line scales 86 to 96. **Colour**: Head, body, and fins reddish brown to red, with horizontal to oblique blue lines on rear of head and anterodorsally on body; vertical blue lines (or dashes) anteriorly on side of body (at least in adults), and numerous blue spots elsewhere on body and on caudal fin; dorsal and anal fins with blue lines and spots; pectoral fins pale yellowish, with basal two-thirds of rays dark brown and a few blue lines at base of fin; pelvic fins with brownish red rays and blue membranes.

Geographical Distribution: Western Pacific Ocean: Philippines, Indonesia, New Guinea, northeastern Australia (Cape York to northern Great Barrier Reef), Belau, Truk, Caroline Islands, Marshall Islands, and the Solomon Islands (Fig. 508).

Habitat and Biology: Coral reefs in 4 to 40 m. Very little has been published on the biology of this rare species. According to Schroeder (1980), "Groups of two or three often forage together for rock- and sand living crustaceans and fishes."

Size: Attains 75 cm total length.

Interest to Fisheries: *P. oligacanthus* is well known in the Philippines, but it seems to be rare elsewhere. It is of minor importance in artisanal fisheries, and it has been implicated in cases of ciguatera fish poisonings. Caught with hook-and-line, spear, and in traps.

Local Names: MICRONESIA: Blue-lined coral trout; PHILIPPINES: Vermiculate coral trout, Lapu-lapung pula, Sunong pula, Mambo.

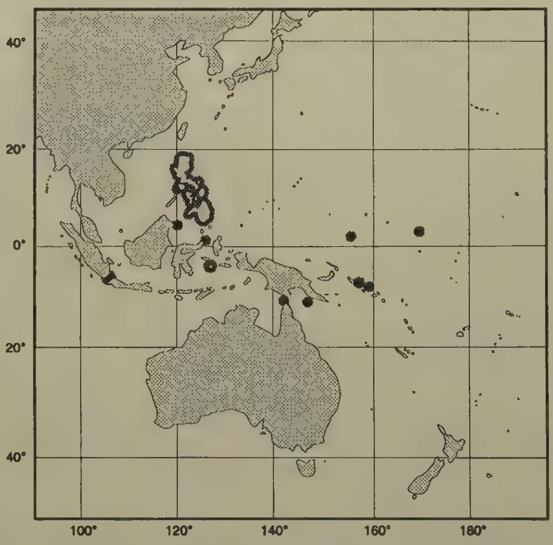


Fig. 508

Literature: Randall and Hoese (1986); Randall and Heemstra (1991).

Remarks: *P. oligacanthus* is the most distinctive and rarest species of the genus *Plectropomus*.

Plectropomus pessuliferus Fowler, 1904 Fig. 509; Pl. XXXB,C **SERRAN Plect 7**

Plectropoma pessuliferum Fowler, 1904:520, pl. 17, upper fig. (type locality: Padang, Sumatra).

Synonyms: ***Perca miniata*** variety C Forsskål, 1775:42 (Red Sea). ***Plectropoma maculatum*** variety D Playfair and Günther, 1867:13 (Zanzibar). ***Plectropoma maculatum*** variety A (in part) Boulenger, 1895:161 (Zanzibar).

FAO Names: **En** - Roving coralgrouper; **Fr** - Mérou-loche vagabonde; **Sp** - Mero errante.

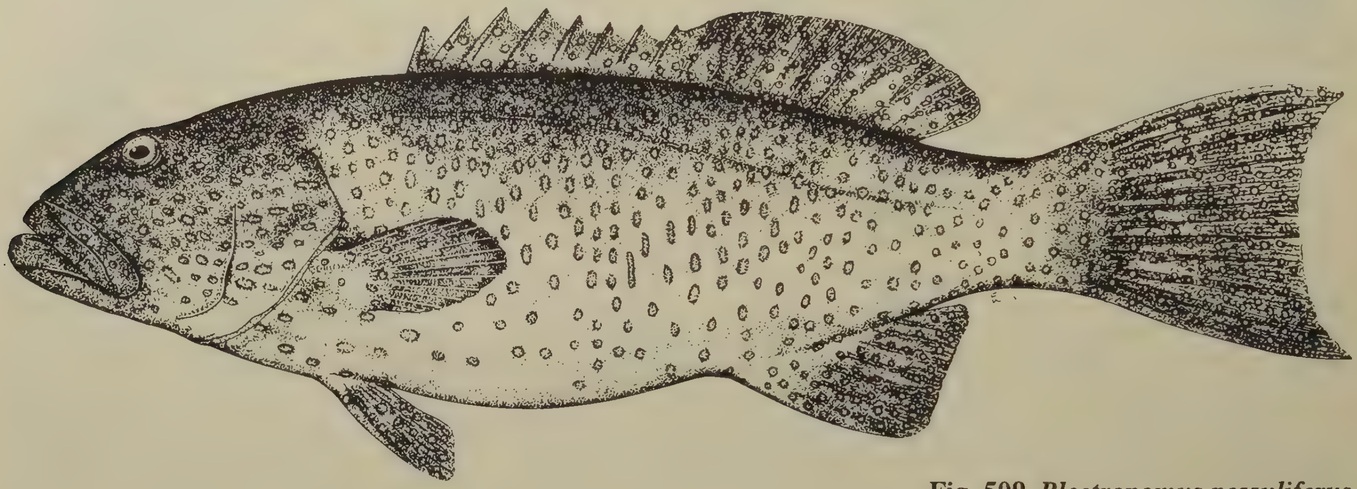


Fig. 509 ***Plectropomus pessuliferus***
(480 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 15 to 63 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils set in a shallow groove running forward from eye; nostrils subequal for fish less than about 30 cm standard length, the posterior nostrils often enlarged in larger fish; midlateral part of lower jaw with 1 to 4 enlarged fixed canines. Developed gill rakers on lower limb 7 to 10, the gill raker at angle shorter than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest ray contained 2.3 to 3.0 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult to see in large fish; pectoral-fin rays 15 or 16; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.9 to 2.3 times in head length; caudal fin emarginate (truncate in juveniles), the caudal concavity contained 4.6 to 6.2 times in head length. Lateral-line scales 85 to 104. Pyloric caeca 3, large and finger-like.

Colour: Head, body, and fins brown to orange-red, with numerous small dark-edged blue spots; some spots on head and sides of body of adults are elongated (those on body usually vertically elongate); spots few or absent on ventral part of body; edge of orbit often blue (may be broken into segments).

Geographical Distribution: Red Sea, Zanzibar, Maldives, St. Brandon's Shoals, Sri Lanka, Chagos, Nazareth Bank, Sumatra, and Fiji (Fig. 510).

Habitat and Biology: *P. pessuliferus* occurs on or near coral reefs at depths of 25 to 147 m.

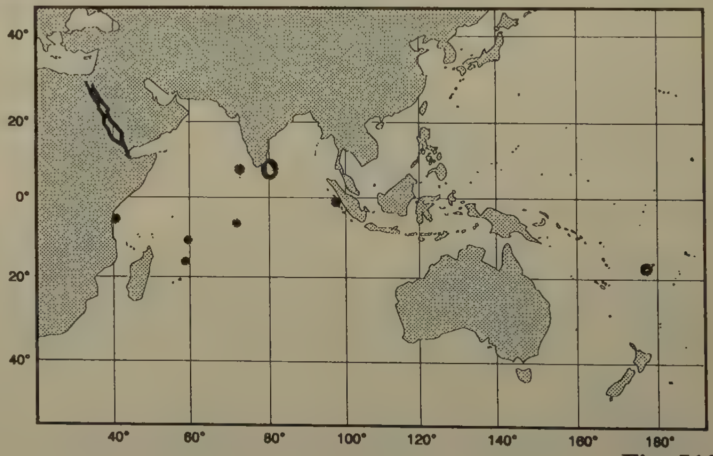


Fig. 510

Size: Attains 120 cm total length in the Red Sea, and at least 63 cm total length in other parts of the Indo-Pacific region.

Interest to Fisheries: A popular food fish on the Arabian coast of the Red Sea. Caught with hook-and-line, spear, and in trawls.

Local Names: SAUDI ARABIA: Nagil.

Literature: Often misidentified as ***P. maculatus***: Kyushin et al. (1977); Wray (1979); Pilosof and Fishelson (1981); Randall (1983); Randall and Ben-Tuvia (1983, in part); Schmid and Vine (1985).

Remarks: Randall and Hoese (1986) recognized two subspecies: ***P. pessuliferus marisrubri*** Randall and Hoese (1986) in the Red Sea, and ***P. pessuliferus pessuliferus*** from the rest of the Indo-Pacific region. The Red Sea subspecies has more numerous blue spots on the cheek (30 to 50 behind and below centre of eye to edge of preopercle, versus 5 to 12 blue spots on cheek of the nominate subspecies); and the pectoral-fin rays of ***P. p. marisrubri*** are dark brown, becoming abruptly pale distally, whereas the pectoral-fin rays are uniformly pale on the other subspecies.

P. pessuliferus differs from ***P. maculatus*** in having the longest gill rakers shorter than the longest gill filaments, some spots on body vertically elongate, and pelvic fins with blue spots.

Plectropomus punctatus Quoy and Gaimard, 1824 | Fig. 511; Pls XXXD-F, XXXIA | SERRAN Plect 5

Plectropoma punctatum Quoy and Gaimard, 1824:318, pl. 45, fig. 1 (type locality: Mauritius).

Synonyms: ***Plectropoma maculatum*** variety G Playfair and Günther, 1867:14 (Seychelles); ***Plectropoma maculatum*** variety E Boulenger, 1895:162 (specimen described by Playfair and Günther, 1867). ***Plectropomus*** sp. Fourmanoir, 1954:216, (Mayotte, Comoro Islands); Kyushin et al. (1977:188, species no. 86, 616 mm fish at top of page). ***Plectropomus marmoratus*** Talbot, 1959:751, pl. 21 (type locality: Zanzibar).

FAO Names: **En** - Marbled coralgrouper (formerly: Mottled coraltrout); **Fr** - Mérou pointillé; **Sp** - Mero pecoso.

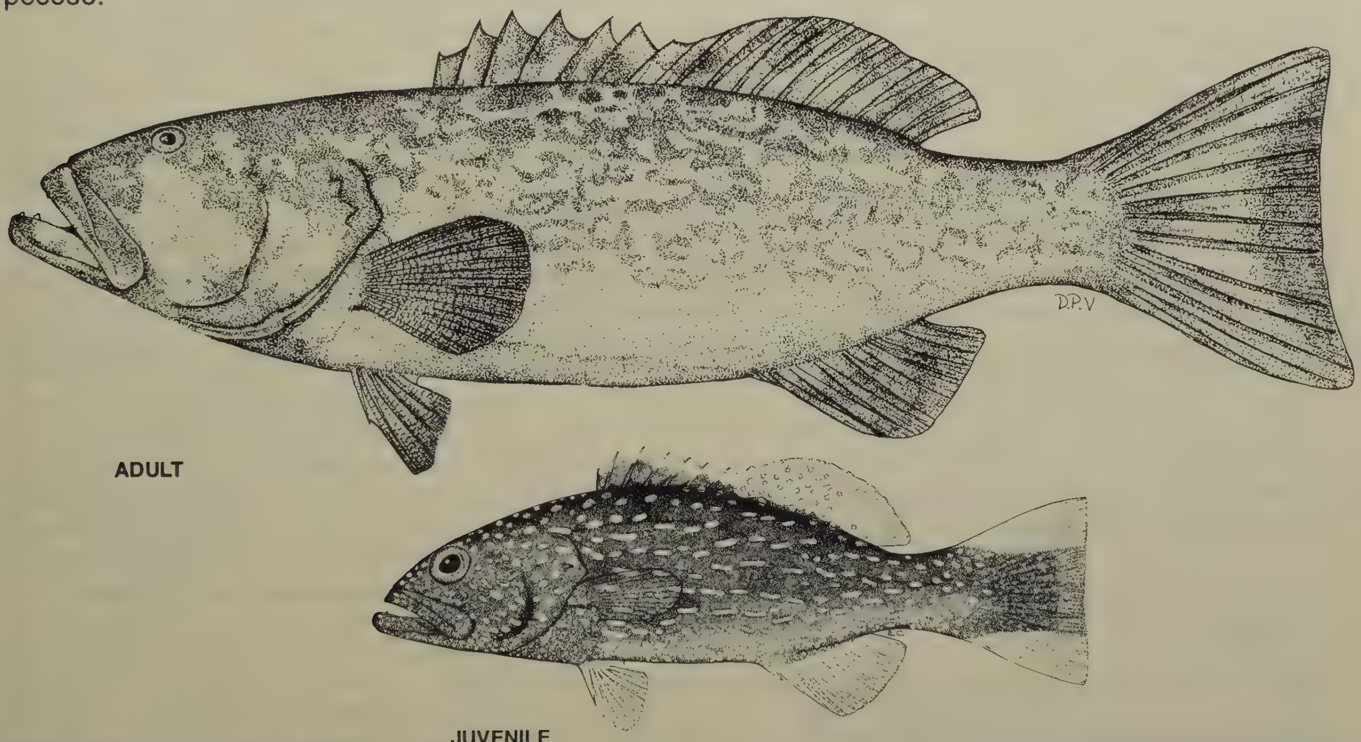


Fig. 511 ***Plectopomus punctatus***
(adult 900 mm standard length, juvenile about 80 mm standard length)

Diagnostic Features: Body elongate, robust, the depth contained 2.9 to 3.9 times in standard length (for fish 15 to 61 cm standard length). Head length contained 2.7 to 3.1 times in standard length; snout length contained 2.8 to 3.6 times in head length; suborbital depth contained 5.6 to 10 times in head length; interorbital area flat (rounded at edges of orbits), without scales; preopercle broadly rounded, with 3 large, ventrally-directed spines along lower half; interopercle and subopercle smooth; opercle with 3 flat spines, the upper and lower spines covered by skin; nostrils set in a shallow groove in front of eye; rear nostrils larger than front ones on fish more than 60 cm standard length; midlateral part of upper jaw with 1 to 4 enlarged fixed canines. Developed gill rakers on lower limb 2 to 9, gill raker at angle slightly shorter than gill filaments at angle. Dorsal fin with VII or VIII slender spines and 10 to 12 rays, the third or fourth spine longest, its length contained 3.2 to 4.2 times in head length, the longest ray contained 2.3 to 3.2 times in head length; base of spinous part of dorsal fin subequal to that of soft-rayed part; anal fin with III slender spines and 8 rays, the first 1 or 2 spines embedded and difficult see in large fish; pectoral-fin rays 16 to 18; pectoral fins subequal to pelvic fins, pectoral-fin length contained 2.0 to 2.4 times in head length; caudal fin truncate to slightly emarginate, the caudal concavity contained 7 to 16 times in head length. Lateral-line scales 88 to 95. Pyloric caeca 3, large and thick. **Colour**: Adults brown to reddish or purplish brown, often irregularly mottled with pale olive-green, orange, or white; no small blue spots, broad dark bars, or wedge-shaped blotches on body; pectoral fins dark brown; pelvic and anal fins sometimes with a bluish band or row of blue spots distally. Body of juveniles (7 to 12 cm standard length) brownish dorsally, with numerous round or oval pale spots (about half eye diameter in size); interspinous membranes between first 5 dorsal-fin spines black; subadults (14 to 20 cm standard length) with numerous horizontal pale streaks and elongate pale spots (about an eye diameter in length) on head and body.

Geographical Distribution: *P. punctatus* is known only from the western Indian Ocean, but not the Red Sea, Persian Gulf or continental coast from Arabia to India. We have examined specimens or verified records from Kenya, Zanzibar, Mozambique, South Africa, Comoros, Madagascar, Aldabra, Seychelles, Mauritius, St. Brandon's Shoals, Nazareth Bank, and Chagos (Fig. 512).

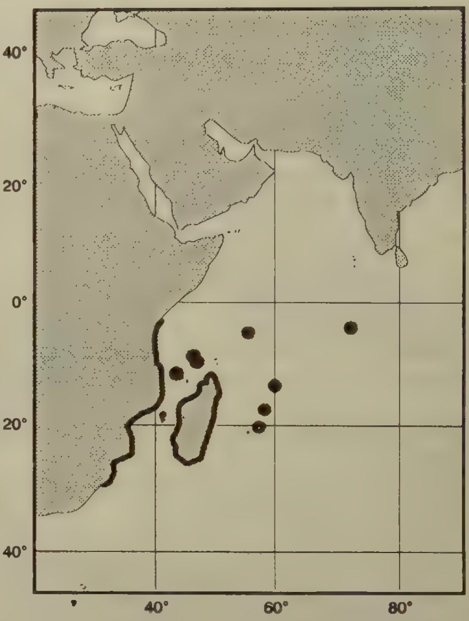


Fig. 512

Habitat and Biology: *P. punctatus* is usually found in shallow water (less than 10 m), however, Kyushin et al. (1977) reported 3 specimens from the Nazareth Bank (northeast of St. Brandon's Shoals) that were caught on a vertical longline at depths of 45 to 62 m. According to Morgans (1982), this species feeds exclusively on fishes, including parrotfishes, wrasses, holocentrids, acanthurids, a triggerfish, and a juvenile *Sphyraena*.

Size: Attains at least 96 cm total length (12.2 kg).

Interest to Fisheries: According to Morgans (1982), *P. punctatus* was common in the markets of Zanzibar in the 1950's. It probably is (or was) also of commercial importance in the Seychelles and Mauritius. Caught with hook-and-line, trolling, spear, and on benthic longlines.

Local Names: KENYA: Njomo; SEYCHELLES and MAURITIUS: Vieille babonne; TANZANIA: Njomo.

Literature: Wheeler and Ommanney (1953, as "*Plectropoma maculatum*"); Morgans (1982, as "*P. marmoratus*"); Randall and Hoese (1986); Randall and Heemstra (1991).

Remarks: Wheeler and Ommanney (1953) reported this species from Aldabra and the Chagos Archipelago.

Saloptia Smith, 1964

SERRAN Salop

Saloptia Smith, 1964:719; type species, *Saloptia powelli* Smith, by original designation and monotypy.

Synonyms: None.

Species: The genus *Saloptia* comprises a single species.

Remarks: We agree with Leis (1986) and J.L.B. Smith (1964) that *Saloptia* is closely related to *Plectropomus*. The species of these two genera are the only groupers with a single supraneural bone, a dorsal fin with VIII spines and 11 rays (10 to 12 rays in *Plectropomus*), 3 large antrorse spines on lower edge of preopercle and only 13 branched caudal-fin rays. *Saloptia* differs from all of the *Plectropomus* species in having conspicuous (robust) anal-fin spines, dorsal-fin spines strong and not much shorter than anterior soft rays, and no enlarged canine teeth at midside of lower jaw.

Saloptia powelli Smith, 1964

Fig. 513; Pl. XXXIB

SERRAN Salop 1

Saloptia powelli Smith, 1964:719, pl. 21 (type locality: Cook Islands).

Synonyms: None.

FAO Names: **En** - Golden grouper; **Fr** - Mérou d'or; **Sp** - Mero dorado.

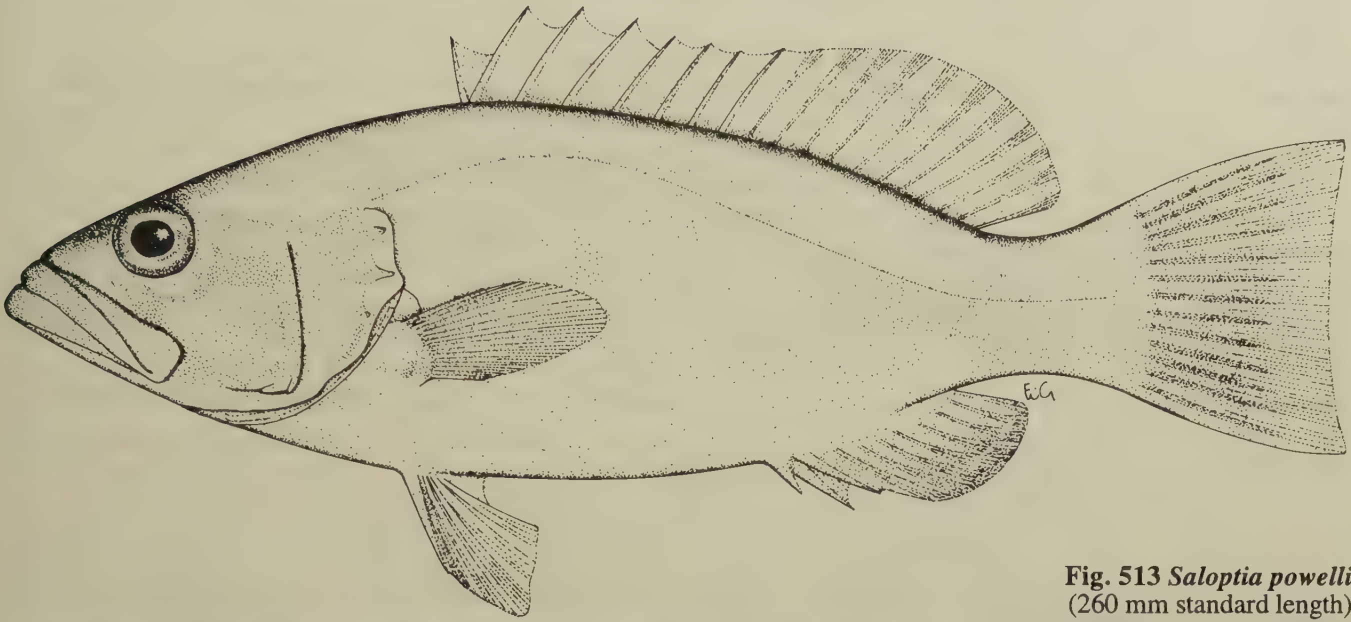


Fig. 513 *Saloptia powelli*
(260 mm standard length)

Diagnostic Features: Body oblong, robust, the depth less than head length and contained 2.6 to 3.0 times in standard length (for fish 24 to 39 cm standard length); body width contained 2.2 times in the depth. Head length contained 2.5 to 2.6 in standard length; snout distinctly longer than eye diameter; interorbital area flat; the dorsal head profile slightly convex; preorbital depth contained 0.4 to 0.5 times eye diameter and 13 times in head length; preopercle subangular, with 3 large curved spines (mostly hidden by skin) on lower edge, the rear edge with minute serrae near the angle; subopercle and interopercle serrate; opercle with 3 flat, equidistant spines; upper edge of operculum distinctly convex; nostrils set in a shallow groove running forward from eye, the posterior nostrils about twice size of anterior nostrils; maxilla not reaching past eye; posterior part of maxilla evenly expanded (no step, hook or knob on ventral edge); supramaxilla well developed; a pair of canines at front of both jaws; lower jaw with 2 rows of teeth, but no enlarged canines at midside of jaw; palatines with teeth. Gill rakers 8 or 9 on upper limb, 16 or 17 on lower limb. Dorsal fin with VIII spines and 11 rays, the dorsal-fin origin close behind vertical at rear end of operculum; dorsal-fin membranes slightly incised between the spines, the third to eighth spines subequal; length of dorsal-fin base less than 50% of standard length; anal fin with III spines and 8 rays; dorsal- and anal-fin spines strong, the anal spines quite distinct; pectoral fins short and rounded, with 14 or 15 rays, the middle rays longest, subequal to pelvic fins, pectoral-fin length contained 2.2 to 2.4 in head length; no scaly flap of skin joining upper pectoral-fin rays to body; caudal fin emarginate, with 7 branched rays and 11 procurrent rays in upper part and 6 branched rays and 10 procurrent rays in lower part. Body scales small, distinctly ctenoid, even on belly; no auxiliary scales; lateral-line scales 70 to 78; lateral-scale series 115 to 133. A single curved supraneural bone anterior to tip of first neural spine; epipleural ribs on vertebrae 1 to 9; dorsal fin with 2, anal fin with 3 trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore incised at tip of third neural spine; cranium not examined. **Colour**: Head, body, and fins yellow to orange-yellow, shading ventrally to white or pink, the snout, lips, and dorsal part of head suffused with red; dorsal-fin spines sometimes streaked with red.

Geographical Distribution: Western Pacific to French Polynesia: Okinawa, Taiwan, South China Sea, Mariana Islands, Society Islands, Cook Islands, American Samoa, Fiji, and the Tuamotus (Fig. 514).

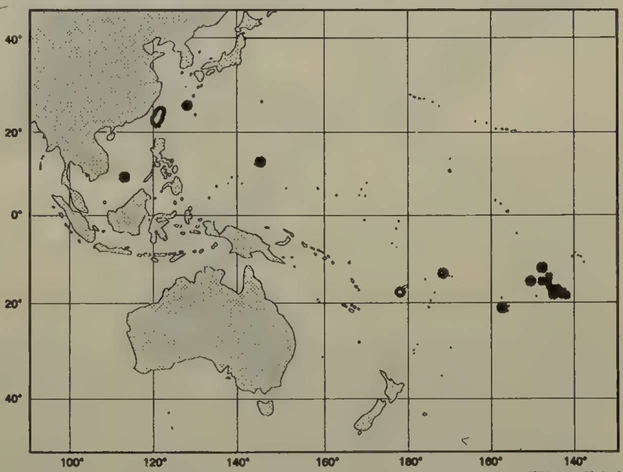


Fig. 514

Habitat and Biology: Deep water (140 to 367 m) on coral reefs or rocky substrata.

Size: Attains at least 47 cm total length (39 cm standard length).

Interest to Fisheries: Although *Saloptia* is not an abundant species it is an important food fish in the Ryukyu Islands of southern Japan. According to Polovina (1987), it is one of the most common deepwater groupers that are caught with handlines at the Marianas.

Local Names: JAPAN: Yamabukihata; TUAMOTU ISLANDS: Paru hoa.

Literature: Wrobel (1988); Randall and Heemstra (1991).

Remarks: Bagnis et al. (1974) reported this species from French Polynesia as "*Epinephelus truncatus*."

Triso Randall, Johnson, and Lowe, 1989

SERRAN Triso

Genus: ***Triso*** Randall, Johnson and Lowe, 1989:415; type species, ***Serranus dermopterus*** Temminck and Schlegel, by original designation and monotypy).

Synonyms: None, although the type species was assigned to the genus ***Trisotropis*** Gill (a synonym of ***Mycteroperca***) by Jordan and Richardson (1910).

Species: The genus ***Triso*** comprises a single species.

Triso dermopterus (Temminck and Schlegel, 1842)

Fig. 515; Pl. XXXIC

SERRAN Triso 1

Serranus dermopterus Temminck and Schlegel, 1842:10 (type locality: Nagasaki, Japan).

Synonyms: ***Altiserranus woorei*** Whitley, 1951:396, fig. 5 (type locality: Laurieton, New South Wales, Australia).

FAO Names: **En** - Oval grouper; **Fr** - Mérou ovale; **Sp** - Mero ovalado.

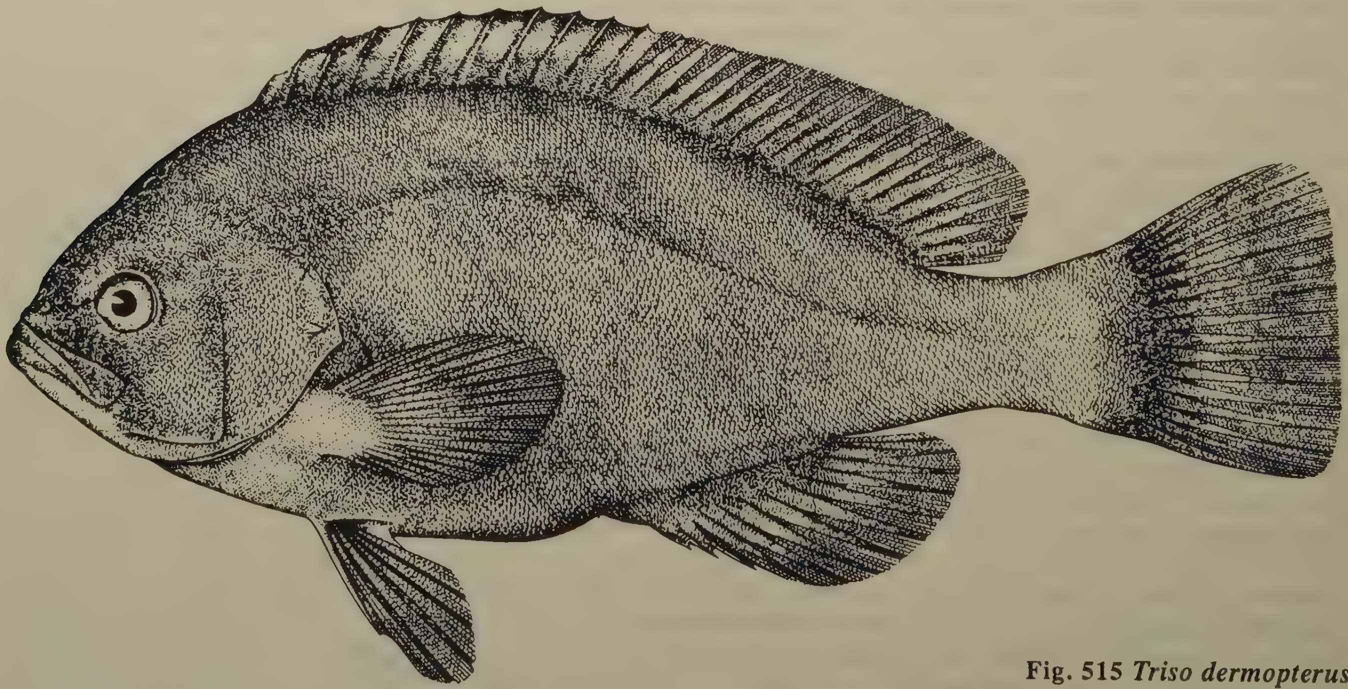


Fig. 515 ***Triso dermopterus***

Diagnostic Features: Body oval (in lateral view), compressed, the depth contained 2.4 to 2.7 times in the standard length (for fish 13 to 56 cm standard length); body width contained 2.0 to 2.8 times in the depth. Head length contained 3.0 to 3.4 times in standard length; dorsal head profile distinctly convex; snout length distinctly longer than eye diameter; interorbital region notably broad and convex, its width contained 1.5 to 2.2 times orbit diameter for fish of 20 to 56 cm; preorbital depth contained 0.6 to 0.9 times eye diameter and 7 to 10 times in head length; preopercle subangular, finely serrate, the serrae at the angle slightly enlarged, the lower edge smooth; subopercle and interopercle also smooth; opercle with 3 flat spines, the upper edge of operculum convex; nostrils subequal in juveniles, the diameter of rear nostrils twice that of front nostrils in a 56 cm adult; mouth small, oblique, the maxilla not reaching past vertical at middle of eye; maxilla scaly, with slender supramaxilla and no hook or step on ventral edge; lower jaw projecting, with 2 or 3 small exserted canines on each side of symphysis; midside of lower jaw with about 5 rows of villiform teeth; a pair of short canines at front of each premaxilla; palatines and vomer with teeth. Gill rakers 8 or 9 on upper limb, 16 to 18 on lower limb, no rudiments, the longest raker slightly shorter than the longest filaments on first arch. Dorsal fin with XI spines and 18 to 21 rays, the fin origin above opercle; dorsal-fin membranes not (or only slightly) incised between the spines, the 4th to 11th spines subequal; dorsal-fin base about 60% of standard length; anal fin with III spines and 9 to 12 rays, the third spine longest; pectoral fins asymmetrical, with 18 to 20 rays, the upper rays longest, their length contained 1.4 to 1.6 times in head length; a well-developed scaly flap of skin joining upper pectoral-fin rays to body; pelvic-fin length contained 1.4 to 1.7 times in head length; caudal fin truncate to emarginate, the corners rounded; caudal fin with 8 branched rays and 10 procurrent rays in upper part and 7 branched rays and 10 procurrent rays in lower part. Small ctenoid scales on head and body; no auxiliary scales; lateral-line scales 67 to 76; lateral-scale series 131 to 145. Esophagus with 1 to 3 pouch-like swellings on each side just anterior to stomach; pyloric caeca 14 to 16. Two large supraneural bones, the first supraneural expanded distally and shaped like a hockey stick; no trisegmental pterygiophores in the dorsal and anal fins; cranium short; anterior part of parasphenoid bent upward just below basisphenoid; frontoparietal crests well developed, inclined laterally and extending to front edge of orbits; interorbital area of frontals distinctly convex; medial process of epioccipitals shorter than lateral process. **Colour**: Dark brown or violet-black, the fins darker.

Geographical Distribution: Anti-tropical in the eastern Indian Ocean and western Pacific. ***Triso dermopterus*** is in the Northern Hemisphere known from Korea, Japan, Taiwan, Hong Kong, and the Fujian Province of China; in the Southern Hemisphere it occurs off the coast of Western Australia (south of 19°30'S) and off eastern Australia between 25° and 32°S (Fig. 516).

Habitat and Biology: ***T. dermopterus*** has been seen or caught on rocky or soft (silty-sand or mud) bottoms at depths of 22 to 103 m. Juveniles feed in the water column on zooplankton. Feeding by adults has not been observed.

Size: Attains at least 68 cm total length.

Interest to Fisheries: ***T. dermopterus*** is of minor importance in the commercial fishery of Japan and Hong Kong. No data are available on the landings of this species. Caught with hook-and-line and trawls.

Local Names: HONG KONG: Melon-seed grouper, Kwah-tsee paan; JAPAN: Tobihata.

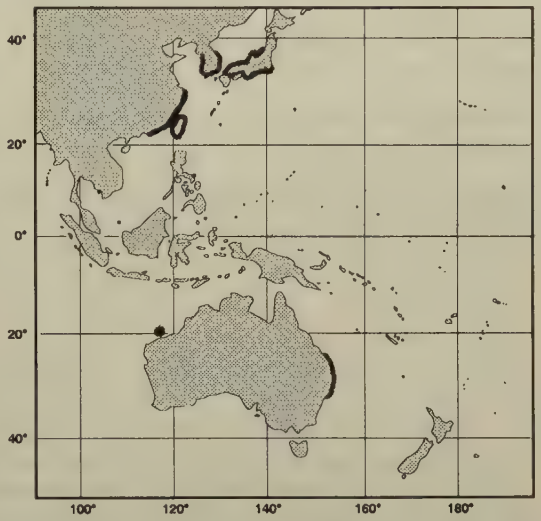


Fig. 516

Literature: Randall et al. (1989); Randall and Heemstra (1991).

Remarks: Randall et al. (1989) suggested that ***Triso*** is most closely related to the American groupers of the genus ***Paranthias***. The senior author of the present work (P.C. Heemstra) is sceptical of this proposed relationship. A detailed criticism of this hypothesis is inappropriate for this world catalogue and will be presented in another paper.

Variola Swainson, 1839

SERRAN Vari

Variola Swainson, 1839:202; type species, ***Variola longipinna*** Swainson (=***Variola louti***), by monotypy.

Synonyms: ***Pseudoserranus*** Klunzinger, 1870:687; type species, ***Perca louti*** Forsskål, by monotypy.

Diagnostic Features: Body oblong, the depth less than head length and contained 2.8 to 3.2 times in standard length; body width contained 1.6 to 2.3 in the depth. Head length contained 2.5 to 2.8 in standard length; interorbital area of adults convex; dorsal head profile slightly convex; snout distinctly longer than eye diameter; preorbital depth contained 0.6 to 1.4 times eye diameter and 6 to 10 times in head length; preopercle rounded, finely serrate, the lower edge fleshy; opercle with 3 flat spines; upper edge of operculum almost straight; subopercle and interopercle smooth; posterior nostrils not much bigger than anterior nostrils;

maxilla of adults with a distinct step on ventral edge; supramaxilla well developed; both jaws with a pair of large canines at the front; 1 to 3 large canines at midside of lower jaw; palatines with teeth. Dorsal fin with IX spines and 13 to 15 rays, the dorsal-fin origin over rear end of operculum; dorsal-fin membranes not or slightly indented between the spines, the third to ninth spines subequal, the 11th or 12th ray elongated; anal fin with III distinct spines and 8 rays; rear margin of dorsal and anal fins falcate, the antepenultimate rays greatly elongated; pectoral fins rounded, with 16 to 19 rays, the middle rays longest, their length contained 1.4 to 1.8 in head length; upper pectoral-fin rays joined to body by a scaly flap of skin; first two pelvic-fin rays elongated, usually much longer than pectoral fins and reaching to or beyond anal fin origin; caudal fin lunate (the lobes produced), with 8 branched rays and 10 procurrent rays in upper part and 7 branched rays and 10 procurrent rays in lower part. Midlateral-body scales ctenoid, without auxiliary scales. Second supraneural bone about half length of first; epipleural ribs on first 9 or 10 vertebrae; dorsal fin with 4 to 6, anal fin with 4 trisegmental pterygiophores; rear edge of first dorsal-fin pterygiophore slightly excavated at tip of third neural spine; posterior part of parasphenoid deflected slightly ventrally; greatest width of cranium about 0.5 times its length; least interorbital width of frontals about 0.4 times postorbital width of frontals; parietal crest well developed, continued onto frontals where it joins the lateral crest to form a low ridge running anteromedially to meet its fellow of the opposite side; frontals rugose, not excavated anteriorly (no supraethmoid pit or depression); median supraoccipital crest low, not extending onto frontals; exoccipitals with a small notch in lateral edge of foramen magnum.

Habitat and Biology: Both species of *Variola* occur on coral reefs at depths of 4 to 200 m. They are usually seen swimming well above the reef and seem to prefer clear-water areas such as islands and offshore reefs. They feed primarily on fishes.

Geographical Distribution: The species of *Variola* are known from the tropical Indo-Pacific region, from the Red Sea to South Africa and eastward to the islands of the central Pacific.

Interest to Fisheries: As the larger and more common species, *V. louti* is more important in artisanal fisheries, although it is often the cause of ciguatera poisoning.

Remarks: This distinctive genus comprises two very similar species. *V. albimarginata* is less common and was usually misidentified as *V. louti*.

Key to the Species of *Variola*

1a. Rear margin of caudal fin with a black submarginal line and narrow white edge; dorsal, anal, and pectoral fins without a distinct yellow posterior border; lower gill rakers 13 to 16; pelvic fins usually not reaching anus; juveniles without a dark stripe on body dorsally and no dark spot at base of upper caudal-fin rays (Fig. 517, Plate XXXI) (western Indian Ocean to central Pacific Ocean) . . . . *V. albimarginata*

1b. Caudal, dorsal, anal, and pectoral fins with a broad yellow rear margin; lower gill rakers 15 to 18; pelvic fins reach beyond anus; juveniles with irregular dark brown stripe along dorsal part of body and a dark spot at base of upper caudal-fin rays (Fig. 518, Plate XXXI) (Red Sea to central Pacific Ocean) . . . . *V. louti*

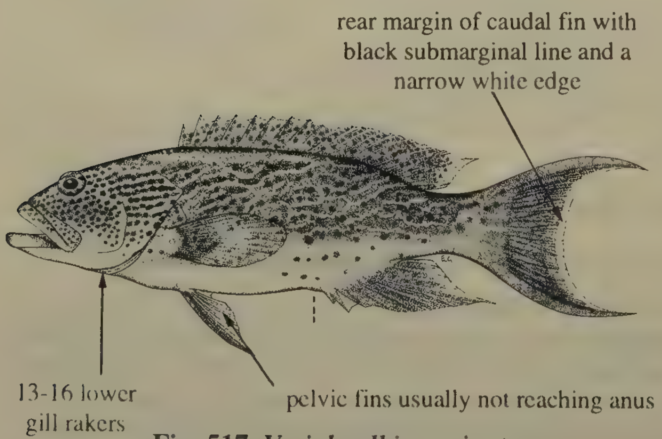

rear margin of caudal fin with black submarginal line and a narrow white edge
13-16 lower gill rakers
pelvic fins usually not reaching anus

Fig. 517 *Variola albimarginata*

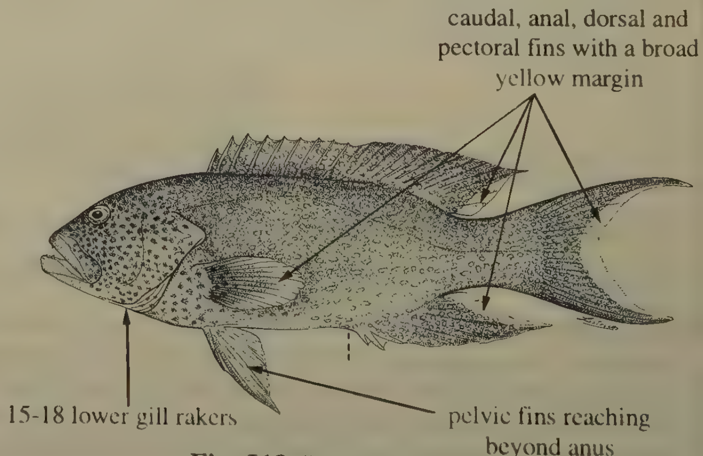

caudal, anal, dorsal and pectoral fins with a broad yellow margin
15-18 lower gill rakers
pelvic fins reaching beyond anus

Fig. 518 *Variola louti*

Variola albimarginata Baissac, 1952

Fig. 519; Pl. XXXID

SERRAN Vari 2

Variola albimarginata Baissac, 1952:214 (type locality: Mauritius).

Synonyms: None. Often misidentified as *V. louti*.

FAO Names: **En** - White-edged lyretail; **Fr** - Croissant queue blanche; **Sp** - Mero rabiblanco.

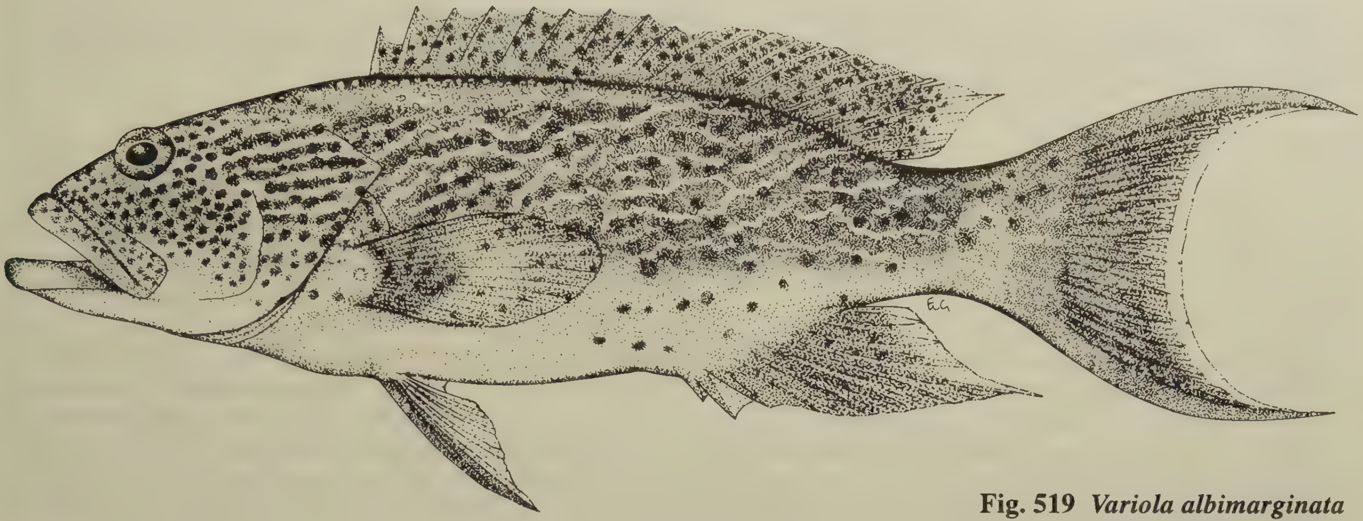


Fig. 519 ***Variola albimarginata***
(212 mm standard length)

Diagnostic Features: Body oblong, the depth less than head length and contained 2.8 to 3.5 times in standard length (for fish 19 to 25 cm standard length). Head length contained 2.6 to 2.8 times in standard length. Gill rakers 7 to 9 on upper limb, 13 to 16 on lower limb (including 4 to 7 rudiments on each limb). Dorsal fin with IX spines and 14 rays; anal fin with III spines and 8 rays; pectoral-fin rays 17 to 19, the middle rays longest, their length contained 1.6 to 1.8 times in head length; pelvic fins usually not reaching anus, pelvic-fin length contained 1.4 to 1.8 times in head length; caudal fin lunate, the upper and lower lobes produced, about twice the length of middle rays. Midlateral-body scales ctenoid, without auxiliary scales; lateral-line scales 66 to 76; lateral-scale series 109 to 127. **Colour**: Body brownish orange or reddish purple, with irregular red bands alternating with yellow lines, the red bands containing small irregular pale blue to pink spots; head orange-yellow, densely spotted with red; median fins with small pink and red spots; rear margin of caudal fin usually dusky, with a narrow white edge; rear margin of dorsal and anal fins hyaline, without trace of yellow; pectoral fins yellow, the basal half of rays often reddish or dark brown. Juveniles similar in colour to adults, but with relatively fewer and larger pale blue or pink spots.

Geographical Distribution: *V. albimarginata* is known from the east coast of Africa (Zanzibar and Mafia Island, Tanzania) to Samoa. We have verified records from Mauritius, Réunion, Maldives, Chagos, Sri Lanka, South China Sea, Indonesia, Philippines, Taiwan, Ryukyu Islands, tropical coast of Australia, Papua New Guinea, New Ireland, New Caledonia, Guam, Palau Islands, Mariana Islands, Fiji, and Samoa (Fig. 520).

Habitat and Biology: *V. albimarginata* occurs on coral reefs at depths of 4 to 200 m. The stomach contents from 3 specimens comprised only fishes. According to Morgans (1982), females are mature at 32 cm standard length.

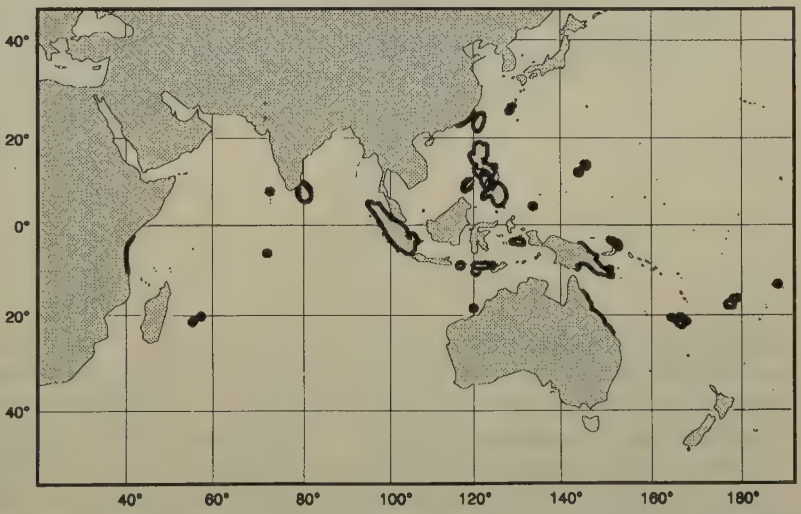


Fig. 520

Size: Appears to be smaller than *V. louti*, the largest known specimen was 33 cm standard length (47 cm total length); probably does not grow larger than 55 cm total length (1 kg).

Interest to Fisheries: Because of its small size and rarity, *V. albimarginata* is of little interest to fisheries. It is, however, abundant during the dry season (southern winter) at Réunion. Flesh excellent. Caught with handline, traps, and spear.

Local Names: AUSTRALIA: Lyretail trout; JAPAN: Ojiro-barahata; MAURITIUS: Vieille mulâtresse, Croissant queue blanche; PHILIPPINES: Painted coral trout, Lunar-tailed grouper, Lapu-lapung señorita, Sunolawian, Mambo; REUNION: Tire bourre; SINGAPORE: Moontail seabass.

Literature: Postel et al. (1963); Morgans (1982); Randall and Heemstra (1991).

Remarks: Although it was described in 1952, *V. albimarginata* was overlooked or misidentified as *V. louti* by most recent authors. *V. albimarginata* was recognized as a valid species by Postel et al. (1963), Morgans (1982), Randall and Ben-Tuvia (1983) and Heemstra and Randall (1984).

Variola louti (Forsskål, 1775) Fig. 521; Pl. XXXIE, F SERRAN Vari 1

Perca louti Forsskål, 1775:40 (type localities, Lohaja, Jeddah, Red Sea).

Synonyms: *Labrus punctulatus* Lacepède, 1801:431, 477, pl. 17, fig. 2 (type locality: Indian Ocean). *Serranus roseus* Valenciennes in Cuv. and Val., 1828:306 (type locality: Tahiti). *Serranus luti* Valenciennes in Cuv. and Val., 1828:363 (unjustified emendation of *Perca louti* Forsskål). *Serranus flavimarginatus* Rüppell, 1830:109 (type locality: Mohila, Red Sea). *Serranus phaenistomus* Swainson, 1839:201 (on *Serranus louti*: Rüppell, 1828). *Variola longipinna* Swainson, 1839:202 (on *Serranus louti*: Rüppell, 1828). *Variola melanotaenia* Bleeker, 1857a:33 (type locality: Ambon, Indonesia). ?*Serranus cernipedis* Miranda Ribeiro, 1915:31 (307) (no locality).

FAO Names: **En** - Yellow-edged lyretail (formerly: Moontail seabass); **Fr** - Croissant queue jaune; **Sp** - Mero luna creciente.

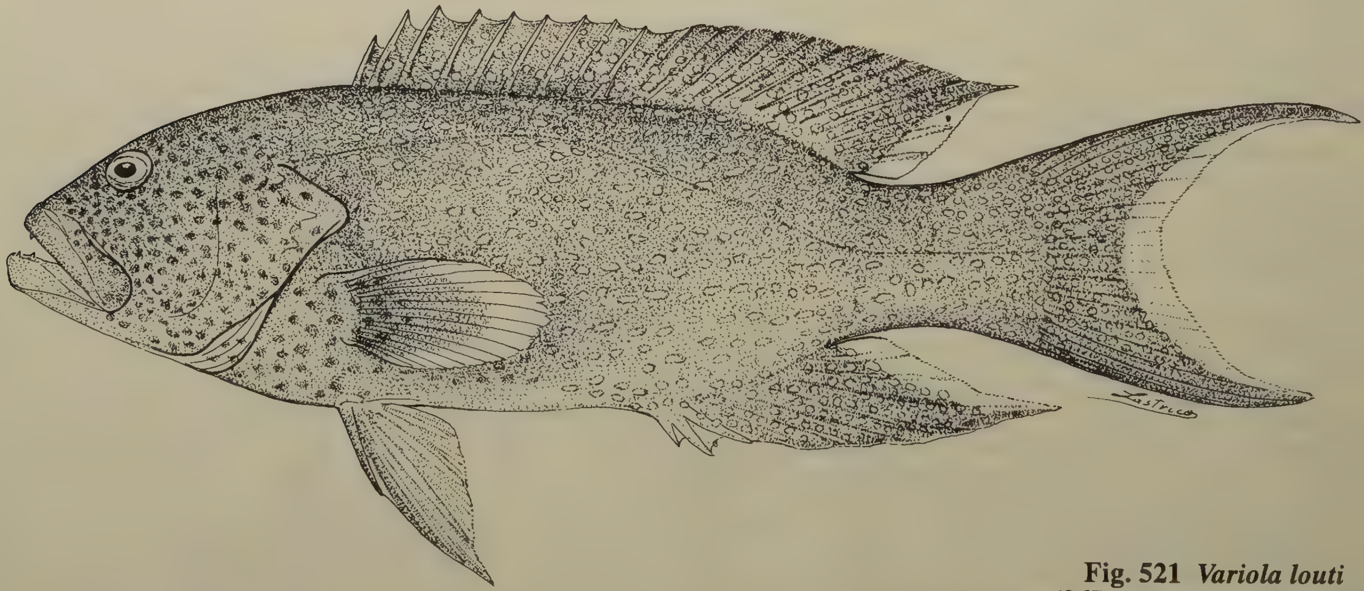


Fig. 521 *Variola louti*
(267 mm standard length)

Diagnostic Features: Body oblong, the depth less than head length and contained 2.8 to 3.3 times in standard length (for fish 12 to 40 cm standard length). Head length contained 2.5 to 2.8 times in standard length. Gill rakers 7 to 10 on upper limb, 15 to 18 on lower limb (including 6 to 8 rudiments on each limb). Dorsal fin with IX spines and 13 or 14 rays; anal fin with III spines and 8 rays; pectoral-fin rays 16 to 19, the middle rays longest, their length contained 1.6 to 1.8 times in head length; pelvic fins of adults reach past anus, pelvic-fin length contained 1.0 to 1.7 times in head length; caudal fin lunate, the upper and lower lobes produced, about twice length of middle rays. Midlateral-body scales ctenoid, without auxiliary scales; lateral-line scales 66 to 77; lateral-scale series 113 to 135. **Colour**: Head, body, and median fins yellowish brown to orange-red (fish from deep water more reddish) with numerous small round or elongate spots of blue to lavender or pink; rear margin of median fins broadly yellow; pectoral-fin rays red to brown, the distal third abruptly yellow. Large juveniles (8 to 18 cm standard length) with irregular black band along dorsal part of body ending below rear of dorsal fin and continuing on head (up to eye) as 3 irregular black spots;

irregular black blotch at base of upper caudal-fin rays; head and body (including black band) with small pale blue to pink spots; a pale yellow or white stripe middorsally on head from tip of lower jaw to dorsal-fin origin. Small juveniles (less than 7 cm standard length) lack the black band and black spots on dorsal part of head and body (see Burgess et al., 1988:pl. 146).

Geographical Distribution: *V. louti* occurs throughout the tropical Indo-Pacific region from the Red Sea to the Pitcairn Islands of eastern Oceania. It is found along the east coast of Africa south to Durban and along the western coast of Australia to Shark Bay. This common and widely distributed grouper is known from most of the tropical islands of the Indian and west central Pacific oceans. In the western Pacific it ranges from Japan (southern Honshu) to New South Wales, Australia (Fig. 522). It has not been found in the Persian Gulf or at the Hawaiian Islands.

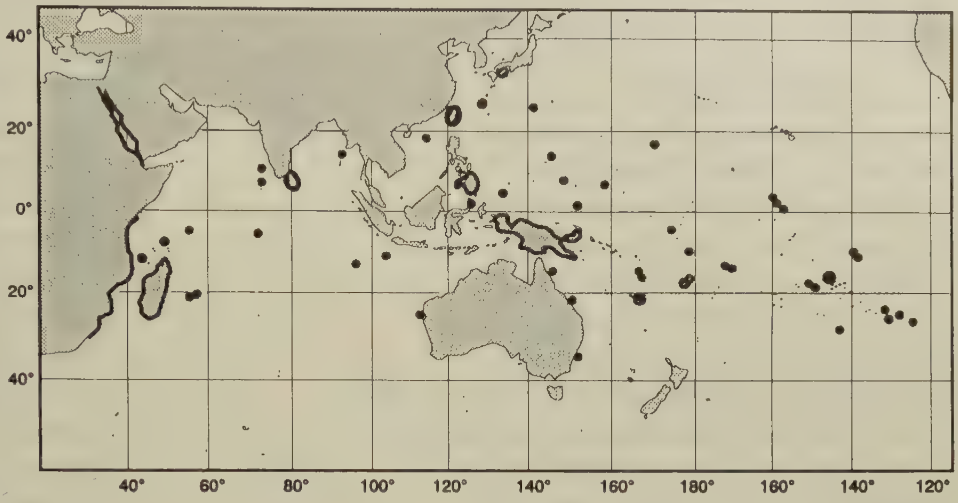


Fig. 522

Habitat and Biology: Coral reefs at depths of 3 to 240 m; usually seen in clear-water areas at depths below 15 m. *V. louti* prefers islands and offshore reefs, rather than continental shores. It feeds primarily on fishes, including a variety of coral-reef species; crustacean prey comprises crabs, shrimps, and stomatopods. Morgans (1982) reported mature females of 33 cm standard length, and spawning occurred between December and February.

Size: Attains at least 81 cm total length (5.5 kg). According to Postel et al. (1963), *V. louti* attains a weight of 12 kg, and van der Elst (1981) gave a maximum length of 100 cm for this species.

Interest to Fisheries: *V. louti* is an important food fish of the Indo-Pacific region, but it often causes ciguatera fish poisoning. Although it is apparently not toxic at Réunion, it is forbidden to be sold at the nearby island of Mauritius. Caught with handlines, spear, and traps.

Local Names: AUSTRALIA: Coronation trout, Lunar-tailed rock-cod; HONG KONG: Lunar-tailed coral-trout, Cheung-may-paan; JAPAN: Bara-hata; MADAGASCAR: Vivano, Mampagnony, Sampamale; MARQUESAS: Pere, Mataiti, Preie; MAURITIUS: Croissant queue jaune; NEW CALEDONIA: Saumonée hirondelle; REUNION: Grand queue; TAHITI: Ho'a; TUAMOTU ISLANDS: Mokohoko.

Literature: Randall (1980a); Morgans (1982); Randall and Heemstra (1991).

Remarks: Although the two species *Variola* have only recently been distinguished, *V. louti* seems much more common than *V. albimarginata*.

3. LIST OF NOMINAL SPECIES OF GROUPERS

The following list gives in order (i) the scientific name as it originally appeared, in alphabetical order according to the specific name; (ii) the author(s) - Cuvier (1829) = in Cuvier and Valenciennes (1829); (iii) date of publication; and (iv) Present identification.

NOMINAL SPECIES	PRESENT ALLOCATION
Serranus abdominalis Peters, 1855	*Epinephelus lanceolatus*
Bodianus acanthistius Gilbert, 1892	*Epinephelus acanthistius*
Serranus acutirostris Valenciennes, 1828	*Mycteroperca acutirostris*
Trachinus Adscensionis Osbeck, 1765	*Epinephelus adscensionis*
Serranus aeneus Geoffroy Saint-Hilaire, 1817	*Epinephelus aeneus*
Epinephelus afer Bloch, 1793	*Alphestes afer*
Trisotropis aguaji Poey, 1867	*Mycteroperca bonaci*
Cephalopholis aitha Randall and Heemstra, 1991	*Cephalopholis aitha*
Serranus aka-ara Temminck and Schlegel, 1842	*Epinephelus akaara*
Serranus alatus Alleyne and Macleay, 1877	*Epinephelus quoyanus*
Epinephelus albimaculatus Seale, 1909	*Epinephelus bleekeri*
Variola albimarginata Baissac, 1953	*Variola albimarginata*
Holocentrus albo-fuscus Lacepède, 1802	*Epinephelus maculatus*
Serranus alboguttatus Valenciennes, 1828	*Epinephelus caeruleopunctatus*
Cephalopholis albomarginatus Fowler and Bean, 1930	*Gracila albomarginata*
Epinephelus albomarginatus Boulenger, 1903	*Epinephelus albomarginatus*
Epinephelus albopunctulatus Boulenger, 1895	*Epinephelus irroratus*
Dermatolepis aldabrensis Smith, 1955	*Dermatolepis striolata*
Serranus Alexandrinus Valenciennes, 1828	*Epinephelus fasciatus*
Serranus altivelioides Bleeker, 1849	*Epinephelus corallicola*
Serranus altivelis Valenciennes, 1828	*Cromileptes altivelis*
Serranus amblycephalus Bleeker, 1857	*Epinephelus amblycephalus*
Serranus amboinensis Bleeker, 1852	*Epinephelus undulosus*
Serranus analis Valenciennes, 1828	*Cephalopholis aurantia*
Epinephelus analogus Gill, 1864	*Epinephelus analogus*
Epinephelus andersoni Boulenger, 1903	*Epinephelus andersoni*
Serranus angularis Valenciennes, 1828	*Epinephelus areolatus*
Serranus angustifrons Steindachner, 1864	*Epinephelus morio*
Serranus apiarius Poey, 1860	*Cephalopholis cruentata*
Bodianus apua Bloch, 1790	*Mycteroperca venenosa*
Serranus ara Temminck and Schlegel, 1842	*Epinephelus trimaculatus*
Bonaci arara Parra, 1787	*Mycteroperca bonaci*
Serranus arara Valenciennes, 1828	*Epinephelus guttatus*
Perca summana areolata Forsskål, 1775	*Epinephelus areolatus*
Plectropoma areolatum Rüppell, 1830	*Plectropomus areolatus*
Anthias argus Bloch, 1792	*nomen dubium*
Cephalopholis argus Bloch and Schneider, 1801	*Cephalopholis argus*
Serranus armatus Osorio, 1894	*?Mycteroperca rubra*
Serranus armatus Saville-Kent, 1893	*nomen nudum*
Serranus aspersus Jenyns, 1843	*Epinephelus marginatus*
Serranus assabensis Giglioli, 1888	*Epinephelus chlorostigma*
Sparus atlanticus Lacepède, 1802	*nomen dubium*
Serranus aurantius Valenciennes, 1828	*Cephalopholis aurantia*
Holocentrus auratus Bloch, 1790	*Cephalopholis fulva*

NOMINAL SPECIES	PRESENT ALLOCATION
Serranus australis Castelnau, 1875	*Epinephelus polystigma*
Serranus awo-ara Temminck and Schlegel, 1842	*Epinephelus awoara*
Serranus bataviensis Bleeker, 1849	*Epinephelus ongus*
Epinephelus bilobatus Randall and Allen, 1987	*Epinephelus bilobatus*
Serranus Bleekeri Vaillant, 1877	*Epinephelus bleekeri*
Serranus boelang Valenciennes, 1828	*Cephalopholis boenak*
Bodianus boenak Bloch, 1790	*Cephalopholis boenak*
Serranus bonaci Poey, 1860	*Mycteroperca bonaci*
Cephalopholis boninius Jordan and Thompson, 1914	*Cephalopholis miniata*
Serranus bontoides Bleeker, 1855	*Epinephelus bontoides*
Serranus bontoo Valenciennes, 1828	*Epinephelus faveatus*
Serranus borbonicus Quoy and Gaimard, 1824	*Epinephelus flavocaeruleus*
Mycteroperca boulengeri Jordan and Starks, 1895	*Mycteroperca xenarcha*
Mycteroperca bowersi Evermann and Marsh, 1902	*Mycteroperca venenosa*
Epinephelus brachysoma Cope, 1871	*Epinephelus marginatus*
Epinephelus bruneus Bloch, 1793	*Epinephelus bruneus*
Serranus brunneus Poey, 1860	*Mycteroperca bonaci*
Pomacentrus burdi Lacepède, 1802	*Cephalopholis miniata*
Holocentrus caeruleo-punctatus Bloch, 1790	*Epinephelus caeruleopunctatus*
Mycteroperca calliura Poey, 1865	*Mycteroperca interstitialis*
Serranus camelopardalis Poey, 1860	*Mycteroperca tigris*
Serranus caninus Valenciennes, 1843	*Epinephelus caninus*
Serranus capreolus Poey, 1860	*Epinephelus adscensionis*
Serranus carauna Valenciennes, 1828	*Cephalopholis fulva*
Bonaci cardenal Parra, 1787	*Mycteroperca venenosa*
Serranus cardinalis Valenciennes, 1828	*Mycteroperca venenosa*
Serranus carinatus Alleyne and Macleay, 1877	*Epinephelus quoyanus*
Serranus castelnaui Jordan and Eigenmann, 1890	*Paranthias furcifer*
Cerna catalonica Gibert, 1913	*Epinephelus costae*
Serranus catus Valenciennes, 1828	*Epinephelus guttatus*
Serranus celebicus Bleeker, 1851	*Epinephelus areolatus*
Serranus cernioides Capello, 1868	*Epinephelus marginatus*
Serranus cernipedis Miranda-Ribeiro, 1915	*?Variola louti*
Serranus Chabaudi Castelnau, 1861	*Epinephelus chabaudi*
Epinephelus chalinius Cope, 1871	*Mycteroperca acutirostris*
Anthias cherna Parra in Bloch and Schneider, 1801	*Epinephelus striatus*
Epinephelus chewa Morgans, 1966	*Epinephelus tauvina*
Serranus chlorocephalus Valenciennes, 1830	*Epinephelus chlorocephalus*
Plectropoma chloropterum Valenciennes, 1828	*Alphestes afer*
Serranus chlorostigma Valenciennes, 1828	*Epinephelus chlorostigma*
Trisotropis chlorostomus Poey, 1867	*Mycteroperca interstitialis*
Sparus chrysomelanus Lacepède, 1802	*nomen dubium*
Cerna chrysotaenia Döderlein, 1882	*Epinephelus costae*
Mycteroperca cidi Cervigón, 1966	*Mycteroperca cidi*
Epinephelus cifuentesi Lavenberg and Grove, 1993	*Epinephelus cifuentesi*
Epinephelus clarkei Smith, 1958	*Epinephelus chabaudi*
Cephalopholis coatesi Whitley, 1937	*Cephalopholis sexmaculata*
Bola? coioides Hamilton, 1822	*Epinephelus coioides*
Serranus colonus Valenciennes, 1855	*Paranthias colonus*

NOMINAL SPECIES	PRESENT ALLOCATION
Epinephelus cometae Tanaka, 1927	*Epinephelus morrhua*
Epinephelus compressus Postel, Fourmanoir and Guézé, 1963	*Epinephelus octofasciatus*
Serranus confertus Bennett, 1830	*nomen dubium*
Serranus conspersus Poey, 1860	*Epinephelus niveatus*
Serranus corallicola Valenciennes, 1828	*Epinephelus corallicola*
Serranus Coromandelicus Day, 1878	*Epinephelus bleekeri*
Serranus coronatus Valenciennes, 1828	*Cephalopholis cruentata*
Serranus costae Steindachner, 1878	*Epinephelus costae*
Serranus Courtadei Bocourt, 1868	*Epinephelus analogus*
Serranus crapao Cuvier, 1829	*Epinephelus malabaricus*
Epinephelus craspedurus Jordan and Richardson, 1910	*Epinephelus areolatus*
Serranus creolus Valenciennes, 1828	*Paranthias furcifer*
Sparus cruentatus Lacepède, 1802	*Cephalopholis cruentata*
Serranus cruentus De Vis, 1884	*Epinephelus fasciatus*
Epinephelus cubanus Poey, 1866	*Epinephelus guttatus*
Epinephelus Cuvieri Bleeker, 1875	*Mycteroperca acutirostris*
Serranus cuvieri Smith, 1831	*nomen dubium*
Serranus cyanopodus Richardson, 1846	*Epinephelus cyanopodus*
Plectropoma cyanostigma Bleeker, 1845	*Plectropomus leopardus*
Serranus cyanostigma Valenciennes, 1828	*Cephalopholis cyanostigma*
Serranus cyanostigmatoides Bleeker, 1849	*Cephalopholis miniata*
Serranus cyclopomatus Poey, 1861	*Mycteroperca bonaci*
Bodianus cyclostomus Lacepède, 1802	*Plectropomus laevis*
Epinephelus cylindricus Postel, 1965	*Epinephelus malabaricus*
Serranus cylindricus Günther, 1859	*Epinephelus macrospilos*
Serranus Dämelii Günther, 1876	*Epinephelus daemelii*
Epinephelus darwinensis Randall and Heemstra, 1991	*Epinephelus darwinensis*
Epinephelus Dayi Bleeker, 1873	*Epinephelus diacanthus*
Epinephelus Dayi Bleeker, 1875	*Epinephelus bleekeri*
Serranus decimalis Poey, 1860	*Mycteroperca bonaci*
Epinephelus dermatolepis Boulenger, 1895	*Dermatolepis dermatolepis*
Serranus dermochirus Valenciennes, 1830	*Epinephelus caeruleopunctatus*
Serranus dermopterus Temminck and Schlegel, 1842	*Triso dermopterus*
Serranus diacanthus Valenciennes, 1828	*Epinephelus diacanthus*
Serranus diacopaeformis Bennett, 1830	*nomen dubium*
Serranus dichropterus Valenciennes, 1828	*Epinephelus ongus*
Serranus diktiophorus Bleeker, 1856	*Epinephelus miliaris*
Serranus dimidiatus Poey, 1860	*Mycteroperca interstitialis*
Serranus dispar Playfair, 1867	*Epinephelus polyphekadion*
Promicrops ditobo Roux and Collignon, 1954	*?Epinephelus itajara*
Epinephelus döderleinii Franz, 1910	*Epinephelus radiatus*
Epinephelus Drummond-Hayi Goode and Bean, 1879	*Epinephelus drummondhayi*
Serranus dubius Poey, 1860	HYBRID: *Cephalopholis fulva* x *Paranthias furcifer*
Epinephelus elongatus Schultz, 1953	*Epinephelus tauvina*
Serranus emarginatus Valenciennes, 1843	*?Mycteroperca fusca*
Epinephelus emoryi Schultz, 1953	*Epinephelus fasciatus*
Serranus epistictus Temminck and Schlegel, 1842	*Epinephelus epistictus*
Epinephelus ergastularius Whitley, 1930	*Epinephelus ergastularius*

NOMINAL SPECIES	PRESENT ALLOCATION
Holocentrus erythraeus Bloch and Schneider, 1801	*Epinephelus fasciatus*
Serranus erythraeus Valenciennes, 1830	*Cephalopholis urodeta*
Serranus erythrogaster DeKay, 1842	*Epinephelus morio*
Serranus erythrurus Valenciennes, 1828	*Epinephelus erythrurus*
Epinephelus esonue Ehrenbaum, 1914	*?Epinephelus itajara*
Serranus estuarius Macleay, 1884	*?Epinephelus malabaricus*
Serrihastaperca exsul Fowler, 1944	*Epinephelus exsul*
Serranus falcatus Poey, 1860	*Mycteroperca interstitialis*
Perca fario Thunberg, 1793	*nomen dubium*
Perca fasciata Forsskål, 1775	*Epinephelus fasciatus*
Serranus fasciatomaculosus Peters, 1866	*Epinephelus fasciatomaculosus*
Alphestes fasciatus Hildebrand, 1946	*Alphestes immaculatus*
Plectropoma fasciatus Costa, 1836	*Epinephelus costae*
Serranus faveatus Valenciennes, 1828	*Epinephelus faveatus*
Serranus felinus Poey, 1860	*Mycteroperca tigris*
Serranus fimbriatus Lowe, 1836	*Epinephelus marginatus*
Perca flava-purpurea Bennett, 1830	*Epinephelus flavocaeruleus*
Hyporthodus flavicauda Gill, 1862	*Epinephelus niveatus*
Serranus flavimarginatus Rüppell, 1830	*Variola louti*
Holocentrus flavo-caeruleus Lacepède, 1802	*Epinephelus flavocaeruleus*
Serranus flavoguttatus Peters, 1855	*Epinephelus caeruleopunctatus*
Epinephelus flavolimbatus Poey, 1865	*Epinephelus flavolimbatus*
Sciaena formosa Shaw and Nodder, 1812	*Cephalopholis formosa*
Cephalopholis formosanus Tanaka, 1911	*Cephalopholis miniata*
Holocentrus forskael Lacepède, 1802	*Epinephelus fasciatus*
Epinephelus forsythi Whitley, 1937	*Epinephelus daemelii*
Labrus fulvus Linnaeus, 1758	*Cephalopholis fulva*
Serranus furcifer Valenciennes, 1828	*Paranthias furcifer*
Perca fusca Thunberg, 1793	*nomen dubium*
Perca summana fusco-guttata Forsskål, 1775	*Epinephelus fuscoguttatus*
Epinephelus fuscus Fourmanoir, 1961	*Epinephelus miliaris*
Serranus fuscus Lowe, 1836	*Mycteroperca fusca*
Epinephelus gabriellae Randall and Heemstra, 1991	*Epinephelus gabriellae*
Serranus Gaimardi Valenciennes, 1830	*Epinephelus miliaris*
Alphestes galapagensis Fowler, 1944	*Alphestes immaculatus*
Serranus galeus Müller and Troschel, 1848	*?Epinephelus itajara*
Serranus Geoffroyi Klunzinger, 1870	*Epinephelus chlorostigma*
Serranus geographicus Valenciennes, 1828	*Epinephelus lanceolatus*
Serranus geometricus De Vis, 1885	*Epinephelus fasciatus*
Serranus gibbosus Boulenger, 1887	*Dermatolepis striolata*
Cephalopholis gibbus Fourmanoir, 1954	*Cephalopholis sexmaculata*
Batrachus gigas Günther, 1869	*Epinephelus lanceolatus*
Perca gigas Brünnich, 1768	*nomen dubium*
Serranus Gilberti Richardson, 1842	*Epinephelus quoyanus*
Serranus glaucus Day, 1870	*Epinephelus areolatus*
Serranus Goldiei Macleay, 1883	*Epinephelus tauvina*
Serranus Goldmanni Bleeker, 1855	*Epinephelus polyphekadion*
Serranus goliath Peters, 1855	*nomen dubium*
Oligorus Goliath De Vis, 1883	*Epinephelus lanceolatus*

NOMINAL SPECIES	PRESENT ALLOCATION
Serranus goreensis Valenciennes, 1830	*Epinephelus goreensis*
Epinephelus grammatophorus Boulenger, 1903	*Epinephelus rivulatus*
Serranus grammicus Day, 1867	*Epinephelus latifasciatus*
Serranus guasa Poey, 1861	*?Epinephelus itajara*
Bodianus guativere Para in Bloch and Schneider, 1801	*Cephalopholis fulva*
Homalogrystes Guntheri Alleyne and Macleay, 1877	*?Epinephelus coioides*
Perca guttata Linnaeus, 1758	*Epinephelus guttatus*
Bodianus guttatus Bloch, 1790	*Cephalopholis argus*
Johnius guttatus Para in Bloch and Schneider, 1801	*Mycteroperca venenosa*
Serranus guttulatus Macleay, 1879	*Epinephelus undulatostriatus*
Labrus gvaza Linnaeus, 1758	*nomen dubium*
Serranus gymnopareius Valenciennes, 1828	*Epinephelus striatus*
Holocentrus gymnosus Lacepède, 1802	*Epinephelus flavocaeruleus*
Epinephelus haifensis Ben-Tuvia, 1953	*Epinephelus haifensis*
Epinephelus hata Katayama, 1953	*Epinephelus heniochus*
Serranus hemistiktos Rüppell, 1830	*Cephalopholis hemistiktos*
Epinephelus heniochus Fowler, 1904	*Epinephelus heniochus*
Holocentrus hexagonatus Forster in Bloch and Schneider, 1801	*Epinephelus hexagonatus*
Plectropoma hispanum Cuvier, 1828	*Gonioplectrus hispanus*
Serranus Hoedtii Bleeker, 1855	*Epinephelus cyanopodus*
Serranus Hoevenii Bleeker, 1849	*Epinephelus caeruleopunctatus*
Serranus homfrayi Day, 1870	*Cephalopholis leopardus*
Epinephelus homosinensis Whitley, 1944	*Epinephelus rivulatus*
Mycteroperca hopkinsi Jordan and Rutter, 1889	*Mycteroperca tigris*
Serranus horridus Valenciennes, 1828	*Epinephelus fuscoguttatus*
Epinephelus summana hostiaretis Whitley, 1954	*?Epinephelus ongus*
Serranus howlandi Günther, 1873	*Epinephelus howlandi*
Cephalopholis igarashiensis Katayama, 1957	*Cephalopholis igarashiensis*
Alphestes immaculatus Breder, 1936	*Alphestes immaculatus*
Serranus immunerur Thiollière, 1857	*Cephalopholis argus*
Serranus impetiginosus Müller and Troschel, 1848	*Epinephelus adscensionis*
Bodianus indelebilis Fowler, 1904	*Cephalopholis aurantia*
Epinephelus indistinctus Randall and Heemstra, 1991	*Epinephelus indistinctus*
Serranus inermis Valenciennes, 1833	*Dermatolepis inermis*
Serranus interstitialis Poey, 1860	*Mycteroperca interstitialis*
Epinephelus ionthas Jordan and Metz, 1913	*Epinephelus akaara*
Perca irrorata Forster, 1844	*Epinephelus irroratus*
Percam irroratam Forster in Bloch and Schneider, 1801	*Epinephelus irroratus*
Serranus itajara Lichtenstein, 1822	*Epinephelus itajara*
Bodianus jacob-evertsen Lacepède, 1802	*Cephalopholis argus*
Serranus Jansenii Bleeker, 1857	*?Epinephelus tauvina*
Epinephelus janthinopterus Bleeker, 1874	*Cephalopholis sonnerati*
Serranus areolatus japonicus Temminck and Schlegel, 1842	*Epinephelus chlorostigma*
Epinephelus jayakari Boulenger, 1889	*Epinephelus multinotatus*
Epinephelus jordani Jenkins and Evermann, 1889	*Mycteroperca jordani*
Cephalopholis kendalli Evermann and Seale, 1907	*Cephalopholis cyanostigma*
Epinephelus kohleri Schultz, 1953	*Epinephelus cyanopodus*
Plectropoma kulas Thiollière, 1856	*?Epinephelus maculatus*
Serranus Kunhardtii Bleeker, 1851	*Epinephelus caeruleopunctatus*

NOMINAL SPECIES	PRESENT ALLOCATION
Serranus labriformis Jenyns, 1843	*Epinephelus labriformis*
Labrus laevis Lacepède, 1801	*Plectropomus laevis*
Holocentrus lanceolatus Bloch, 1790	*Epinephelus lanceolatus*
Serranus latepictus Poey, 1861	*Mycteroperca bonaci*
Serranus latifasciatus Temminck and Schlegel, 1842	*Epinephelus latifasciatus*
Serranus lebretonianus Hombron and Jacquinot, 1853	*Epinephelus lebretonianus*
Plectropoma leopardinus Cuvier, 1828	*Plectropomus leopardus*
Holocentrus leopardus Lacepède, 1802	*Plectropomus leopardus*
Labrus leopardus Lacepède, 1801	*Cephalopholis leopardus*
Epinephelus leprosus Smith, 1955	*Epinephelus multinotatus*
Serranus leucogrammicus Valenciennes, 1828	*Anyperodon leucogrammicus*
Serranus leucostigma Valenciennes, 1828	*Epinephelus summana*
Epinephelus lightfooti Fowler, 1907	*Alphestes afer*
Plectropoma lineatum Steindachner, 1883	*Cephalopholis polleni*
Serranus lineatus Valenciennes, 1828	*Epinephelus undulosus*
Serranus lineo-ocellatus Guichenot in Dumeril, 1861	*Cephalopholis nigri*
Epinephelus lobotoides Nichols, 1913	*Epinephelus akaara*
Variola longipinna Swainson, 1839	*Variola louti*
Serranus longispinis Kner, 1864	*Epinephelus longispinis*
Perca louti Forsskål, 1775	*Variola louti*
Homalogrystes luctuosus De Vis, 1883	*Epinephelus cyanopodus*
Perca lunaris Forsskål, 1775	*Aethaloperca rogaa*
Lutianus lunulatus Parra in Bloch and Schneider, 1801	*Epinephelus guttatus*
Serranus luridus Ranzani, 1842	*?Epinephelus morio*
Serranus luti Valenciennes, 1828	*Variola louti*
Serranus lutra Valenciennes, 1831	*Epinephelus fuscoguttatus*
Bodianus macrocephalus Lacepède, 1802	*Epinephelus flavocaeruleus*
Cerna macrogenis Sassi, 1846	*Mycteroperca rubra*
Serranus macrospilos Bleeker, 1855	*Epinephelus macrospilos*
Perca maculata Bloch, 1792	*nomen dubium*
Perca maculata Forster, 1844	*Epinephelus fasciatus*
Bodianus maculatus Bloch, 1790	*Plectropomus maculatus*
Cephalopholis maculatus Seale and Bean, 1907	*Cephalopholis miniata*
Holocentrus maculatus Bloch, 1790	*Epinephelus maculatus*
Serranus maculosus Valenciennes, 1828	*Epinephelus guttatus*
Priacanthichthys maderaspatensis Day, 1868	*Epinephelus latifasciatus*
Serranus magnificus Macleay, 1883	*nomen dubium*
Epinephelus magniscuttis Postel, Fourmanoir and Guézé, 1963	*Epinephelus magniscuttis*
Holocentrus malabaricus Bloch and Schneider, 1801	*Epinephelus malabaricus*
Serranus margaritifer Günther, 1859	*Epinephelus niveatus*
Epinephelus marginalis Bloch, 1793	*Epinephelus fasciatus*
Serranus marginatus Lowe, 1834	*Epinephelus marginatus*
Bodianus marginatus Bloch and Schneider, 1801	*Mycteroperca venenosa*
Plectropomus pessuliferus marisrubri Randall and Hoese, 1986	*P. pessuliferus marisrubri*
Serranus marmoratus Klunzinger, 1884	*nomen dubium*
Dermatolepis marmoratus Osburn and Mowbray, 1915	*Dermatolepis inermis*
Plectropomus marmoratus Talbot, 1959	*Plectropomus punctatus*
Serranus mars De Vis, 1884	*Cephalopholis urodeta*
Epinephelus matterni Fowler, 1918	*Epinephelus rivulatus*

NOMINAL SPECIES	PRESENT ALLOCATION
Epinephelus mauritianus Baissac, 1962	*Epinephelus retouti*
Serranus medurensis Günther, 1873	*Epinephelus maculatus*
Serranus megachir Richardson, 1846	*Epinephelus quoyanus*
Perca melanocelidota Gronovius, 1854	*Epinephelus quoyanus*
Bodianus melanoleucus Lacepède, 1802	*Plectropomus laevis*
Epinephelus melanostigma Schultz, 1953	*Epinephelus melanostigma*
Serranus melanotaenia Bleeker, 1857	*Variola louti*
Bodianus melanurus E. Geoffroy Saint-Hilaire, 1817	*Epinephelus areolatus*
Serranus melas Peters, 1855	*nomen dubium*
Sebastes meleagris Peters, 1865	*Epinephelus summana*
Serranus Mentzelii Valenciennes, 1828	?*Epinephelus itajara*
Epinephelus merra Bloch, 1793	*Epinephelus merra*
Holocentrus merou Lacepède, 1802	*nomen dubium*
Centropristis merus Poey, 1868	*Epinephelus nigritus*
Serranus microdon Bleeker, 1856	*Epinephelus polyphekadion*
Trisotropis microlepis Goode and Bean, 1880	*Mycteroperca microlepis*
Uriphaeton microleptes Swainson, 1839	A spurious species concocted from the body of a *Cephalopholis* and the tail of a cornet fish (*Fistularia*).
Serranus micronotatus Rüppell, 1838	*Anyperodon leucogrammicus*
Serranus microprion Bleeker, 1852	*Cephalopholis microprion*
Serranus miliaris Valenciennes, 1830	*Epinephelus miliaris*
Epinephelus miltostigma Bleeker, 1874	*Cephalopholis aurantia*
Perca miniata Forsskål, 1775	*Cephalopholis miniata*
Serranus mo-ara Temminck and Schlegel, 1842	*Epinephelus bruneus*
Epinephelus modestus Gilchrist and Thompson, 1909	*Epinephelus chabaudi*
Plectropoma monacanthus Müller and Troschel, 1848	*Alphestes afer*
Serranus Morio Valenciennes, 1828	*Epinephelus morio*
Serranus morrhua Valenciennes, 1833	*Epinephelus morrhua*
Plectropoma multiguttatum Günther, 1867	*Alphestes multiguttatus*
Serranus multinotatus Peters, 1876	*Epinephelus multinotatus*
Serranus celebicus var. *multipunctatus* Kossman and Räuber, 1877	?*Epinephelus chlorostigma*
Serranus myriaster Valenciennes, 1828	*Cephalopholis argus*
Serranus mystacinus Poey, 1852	*Epinephelus mystacinus*
Serranus mysticalis De Vis, 1885	*nomen dubium*
Centropristes nebulosus Castelnau, 1855	*Paranthias furcifer*
Serranus nebulosus Valenciennes, 1828	*Epinephelus coioides*
Serranus nebulosus Cocco, 1833	?*Mycteroperca rubra*
Serranus nigri Günther, 1859	*Cephalopholis nigri*
Serranus nigriceps Valenciennes, 1830	*Epinephelus adscensionis*
Serranus nigriculus Valenciennes, 1828	*Cephalopholis cruentata*
Serranus nigripinnis Valenciennes, 1828	*Cephalopholis urodeta*
Serranus nigritus Holbrook, 1855	*Epinephelus nigritus*
Serranus nigro-fasciatus Hombron and Jacquinot, 1853	*Cephalopholis boenak*
Epinephelus niphobles Gilbert and Starks, 1897	*Epinephelus niphobles*
Serranus niveatus Valenciennes, 1828	*Epinephelus niveatus*
Cephalopholis obtusauris Evermann and Seale, 1907	*Cephalopholis aurantia*
Holocentrus oceanicus Lacepède, 1802	*Epinephelus fasciatus*
Serranus octocinctus Temminck and Schlegel, 1842	*Epinephelus septemfasciatus*

NOMINAL SPECIES	PRESENT ALLOCATION
Epinephelus octofasciatus Griffin, 1926	*Epinephelus octofasciatus*
Serranus olfax Jenyns, 1843	*Mycteroperca olfax*
Gracila okinawae Katayama, 1974	*Cephalopholis polleni*
Plectropoma oligacanthus Bleeker, 1854	*Plectropomus oligacanthus*
Cephalopholis oligosticta Randall and Ben-Tuvia, 1983	*Cephalopholis oligosticta*
Holocentrus ongus Bloch, 1790	*Epinephelus ongus*
Epinephelus ordinatus Cope, 1871	*Epinephelus labrifromis*
Trachinus osbeck Lacepède, 1800	*Epinephelus adscensionis*
Serranus ouatalibi Valenciennes, 1828	*Cephalopholis fulva*
Corvina oxyptera DeKay, 1842	*Paranthias furcifer*
Serranus pachycentron Valenciennes, 1828	*Cephalopholis boenak*
Serranus panamensis Steindachner, 1876	*Cephalopholis panamensis*
Holocentrus pantherinus Lacepède, 1801	*Epinephelus tauvina*
Mycteroperca pardalis Gilbert, 1892	*Mycteroperca rosacea*
Serranus pardalis Bleeker, 1849	*Epinephelus quoyanus*
Serranus Parkinsonii Valenciennes, 1828	*Epinephelus hexagonatus*
Serranus perguttatus De Vis, 1884	*Cephalopholis miniata*
Epinephelus perplexus Randall, Hoese and Last, 1991	*Epinephelus perplexus*
Epinephelus peruanus Chirichigno, 1963	*?Epinephelus niphobles*
Plectropoma pessuliferum Fowler, 1904	*Plectropomus pessuliferus*
Serranus petrosus Poey, 1860	*Mycteroperca venenosa*
Serranus phaenistomus Swainson, 1839	*Variola louti*
Serranus phaeostigmaeus Fowler, 1907	*Epinephelus lanceolatus*
Serranus phaeton Valenciennes, 1828	A spurious species concocted from the body of a *Cephalopholis* and the tail of a cornet fish (*Fistularia*).
Mycteroperca falcata var. *phenax* Jordan and Swain, 1885	*Mycteroperca phenax*
Paranthias pinguis Walford, 1936	*Paranthias colonus*
Serranus pixanga Valenciennes, 1828	*Epinephelus adscensionis*
Epinephelus Playfayri Bleeker, 1879	*Cephalopholis urodeta*
Serranus poëcilonotus Temminck and Schlegel, 1842	*Epinephelus poecilonotus*
Epinephelus Polleni Bleeker, 1868	*Cephalopholis polleni*
Epinephelus polylepis Randall and Heemstra, 1991	*Epinephelus polylepis*
Serranus polyphekadion Bleeker, 1849	*Epinephelus polyphekadion*
Serranus polypodophilus Bleeker, 1849	*Epinephelus malabaricus*
Serranus polystigma Bleeker, 1853	*Epinephelus polystigma*
Cephalopholis popino Walford, 1936	*Epinephelus acanthistius*
Epinephelus posteli Fourmanoir and Crosnier, 1964	*Epinephelus posteli*
Saloptia powelli Smith, 1964	*Saloptia powelli*
Serranus praeopercularis Boulenger, 1887	*Epinephelus epistictus*
Mycteroperca prionura Rosenblatt and Zahuranec, 1967	*Mycteroperca prionura*
Epinephelus pseudomorrhua Postel, Fourmanoir and Guézé, 1963	*Epinephelus magniscuttis*
Perca punctata Linnaeus, 1758	*Cephalopholis fulva*
Serranus punctatissimus Günther, 1859	*Epinephelus cyanopodus*
Plectropoma punctatum Quoy and Gaimard, 1824	*Plectropomus punctatus*
Dermatolepis punctatus Gill, 1862	*Dermatolepis dermatolepis*
Holocentrus punctatus Bloch, 1790	*?Epinephelus guttatus*
Menephorus punctiferus Poey, 1875	HYBRID: *Cephalopholis fulva* x *Paranthias furcifer*

NOMINAL SPECIES	PRESENT ALLOCATION
Labrus punctulatus Lacepède, 1801	*Variola albimarginata*
Cephalopholis purpureus Fourmanoir, 1966	*Cephalopholis sonnerati*
Epinephelus quernus Seale, 1901	*Epinephelus quernus*
Serranus quinquefasciatus Bocourt, 1868	*Epinephelus itajara*
Serranus Quoyanus Valenciennes, 1830	*Epinephelus quoyanus*
Serranus radiatus Day, 1867	*Epinephelus radiatus*
Epinephelus rahanus Popta, 1918	*Epinephelus polystigma*
Epinephelus rankini Whitley, 1945	*Epinephelus multinotatus*
Epinephelus raymondi Ogilby, 1908	*Epinephelus rivulatus*
Serranus reevesii Richardson, 1846	*Epinephelus chlorostigma*
Serranus remotus Poey, 1860	*Epinephelus morio*
Serranus repandus Poey, 1860	*Mycteroperca tigris*
Serranus reticulatus Valenciennes, 1828	*Epinephelus ongus*
Trisotropis reticulatus Gill, 1865	*Mycteroperca tigris*
Epinephelus Retouti Bleeker, 1874	*Epinephelus retouti*
Serranus rhyncholepis Bleeker, 1852	*Epinephelus rivulatus*
Serranus rivulatus Valenciennes, 1830	*Epinephelus rivulatus*
Serranus rivulatus Poey, 1860	*Mycteroperca tigris*
Perca robusta Couch, 1832	*?Epinephelus aeneus*
Perca rogaa Forsskål, 1775	*Aethaloperca rogaa*
Mycteroperca roquensis Martin Salazar, 1956	*Mycteroperca interstitialis*
Epinephelus rosaceus Streets, 1877	*Mycteroperca rosacea*
Serranus roseus Valenciennes, 1828	*Variola louti*
Holocentrus rosmarus Lacepède, 1802	*Epinephelus fasciatus*
Epinephelus ruber Bloch, 1793	*Mycteroperca rubra*
Gymnocephalus ruber Bloch and Schneider, 1801	*Cephalopholis fulva*
Mycteroperca olfax var. *ruberrima* Jordan and Bollman, 1890	*Mycteroperca olfax*
Epinephelus rubra Baissac, 1962	*nomen nudum*
Serranus rubriniger Saville-Kent, 1893	*nomen nudum*
Serranus rufus Hombron and Jacquinot, 1853	*Cephalopholis aurantia*
Serranus rupestris Valenciennes, 1833	*Mycteroperca venenosa*
Holocentrus salmoïdes Lacepède, 1802	*Epinephelus malabaricus*
Serranus salmonoïdes Valenciennes, 1828	*Epinephelus malabaricus*
Epinephelus salonotus Smith and Smith, 1963	*Epinephelus spilotoceps*
Alphestes sambra Bloch and Schneider, 1801	*?nemipterid*
Alphestes scholanderi Walters, 1957	*Epinephelus niveatus*
Serranus Sebae Bleeker, 1854	*Epinephelus maculatus*
Epinephelus sellicauda Gill, 1863	*Epinephelus labriformis*
Serranus semi-punctatus Valenciennes, 1828	*Epinephelus malabaricus*
Perca 7-fasciata Thunberg, 1793	*Epinephelus septemfasciatus*
Serranus sexfasciatus Valenciennes, 1828	*Epinephelus sexfasciatus*
Serranus sexmaculatus Rüppell, 1830	*Cephalopholis sexmaculata*
Serranus shihpan Richardson, 1846	*Epinephelus akaara*
Cerna Sicana Doderlein, 1882	*?Epinephelus haifensis*
Serranus Simonyi Steindachner, 1891	*Mycteroperca fusca*
Epinephelus slacksmithi Whitley, 1959	*Epinephelus ongus*
Serranus socialis Günther, 1873	*Epinephelus socialis*
Serranus Sonnerati Valenciennes, 1828	*Cephalopholis sonnerati*
Serranus spiloparaeus Valenciennes, 1828	*Cephalopholis spiloparaea*

NOMINAL SPECIES	PRESENT ALLOCATION
Epinephelus spilotoceps Schultz, 1953	*Epinephelus spilotoceps*
Epinephelus spilotus Schultz, 1953	*Epinephelus howlandi*
Serranus spilurus Valenciennes, 1833	*Cephalopholis leopardus*
Serranus spiniger Günther, 1859	*Epinephelus irroratus*
Epinephelus spiramen Whitley, 1945	*Epinephelus rivulatus*
Serranus Stathouderi Vaillant in Vaillant and Bocourt, 1877	*Epinephelus guttatus*
Serranus stellans Richardson, 1842	*Epinephelus hexagonatus*
Bodianus stellatus Blosser, 1909	*Cephalopholis cruentata*
Perca stellio Walbaum, 1792	*Epinephelus adscensionis*
Epinephelus stictus Randall and Allen, 1987	*Epinephelus stictus*
Serranus stigmapomus Richardson, 1846	*Cephalopholis boenak*
Epinephelus stigmogrammacus Cheng and Yang, 1983	*Epinephelus epistictus*
Serranus stoliczkae Day, 1875	*Epinephelus stoliczkae*
Trisotropis stomias Goode and Bean, 1883	*Mycteroperca microlepis*
Anthias striatus Bloch, 1792	*Epinephelus striatus*
Serranus striolatus Playfair, 1867	*Dermatolepis striolata*
Serranus subfasciatus De Vis, 1885	*Epinephelus fasciatus*
Serranus subniger Saville-Kent, 1893	*nomen nudum*
Epinephelus suborbitalis Amaoka and Randall, 1990	*Epinephelus suborbitalis*
Serranus suilexus Saville-Kent, 1893	*nomen nudum*
Serranus suillus Valenciennes, 1828	*Epinephelus coioides*
Epinephelus suitonis Tanaka, 1915	*Epinephelus cyanopodus*
Paracanthistius suji Tanaka, 1916	*Plectropomus leopardus*
Perca summana Forsskål, 1775	*Epinephelus summana*
Plectropoma susuki Cuvier, 1828	*Epinephelus septemfasciatus*
Cephalopholis swanius Tsai, 1960	*Cephalopholis igarashiensis*
Serranus taeniocheirus Valenciennes, 1830	*Epinephelus fuscoguttatus*
Serranus taeniops Valenciennes, 1828	*Cephalopholis taeniops*
Perca tauvina Forsskål, 1775	*Epinephelus tauvina*
Oligorus terrae-reginae Ramsay, 1880	*Epinephelus lanceolatus*
Epinephelus thompsoni Whitley, 1948	*Epinephelus perplexus*
Stereolepoides thompsoni Fowler, 1923	*Epinephelus lanceolatus*
Serranus thyrsites Saville-Kent, 1893	*nomen nudum*
Serranus tigris Valenciennes, 1833	*Mycteroperca tigris*
Epinephelus timorensis Randall and Allen, 1987	*Epinephelus timorensis*
Serranus tinca Cantraine, 1835	*?Mycteroperca rubra*
Epinephelus townsendi Boulenger, 1898	*Epinephelus erythrurus*
Serranus trimaculatus Valenciennes, 1828	*Epinephelus trimaculatus*
Epinephelus trophis Randall and Allen, 1987	*Epinephelus trophis*
Epinephelus truncatus Katayama, 1957	*Epinephelus retouti*
Plectropomus truncatus Fowler and Bean, 1930	*Plectropomus areolatus*
Serranus tsirimen-ara Temminck and Schlegel, 1842	*Epinephelus fasciatus*
Epinephelus tuamotuensis Fourmanoir, 1971	*Epinephelus tuamotuensis*
Epinephelus tukula Morgans, 1959	*Epinephelus tukula*
Serranus tumilabris Valenciennes, 1828	*Epinephelus ongus*
Serranus undulatostriatus Peters, 1867	*Epinephelus undulatostriatus*
Bodianus undulosus Quoy and Gaimard, 1824	*Epinephelus undulosus*
Serranus undulosus Valenciennes, 1828	*Mycteroperca acutirostris*
Serranus unicolor Liénard in Bleeker and Pollen, 1875	*Cephalopholis sonnerati*

NOMINAL SPECIES	PRESENT ALLOCATION
Serranus ura Valenciennes, 1828	*Epinephelus trimaculatus*
Epinephelus urodelops Schultz, 1943	*Cephalopholis leopardus*
Perca urodeta Forster, 1844	*Cephalopholis urodeta*
Perca urodetam Forster in Bloch and Schneider, 1801	*Cephalopholis urodeta*
Serranus urophthalmus Bleeker, 1855	*Anyperodon leucogrammicus*
Plectropoma variegatum Castelnau, 1875	*Plectropomus oligacanthus*
Serranus variegatus Richardson, 1846	*Epinephelus akaara*
Serranus variolosus Valenciennes, 1828	*Epinephelus fasciatus*
Serranus varius Bocourt, 1868	*Epinephelus adscensionis*
Mycteroperca venadorum Jordan and Starks, 1895	*Mycteroperca jordani*
Perca venenosa Linnaeus, 1758	*Mycteroperca venenosa*
Cephalopholis virgatus Fourmanoir, 1954	*Cephalopholis polleni*
Serranus viridipinnis De Vis, 1885	*Epinephelus rivulatus*
Serranus Waandersii Bleeker, 1858	*Epinephelus areolatus*
Altiserranus woorei Whitley, 1951	*Triso dermopterus*
Cephalopholis xanthopterus Allen and Starck, 1975	*Cephalopholis cyanostigma*
Mycteroperca bonaci var. *xanthosticta* Jordan and Swain, 1885	*Mycteroperca bonaci*
Mycteroperca xenarcha Jordan, 1888	*Mycteroperca xenarcha*
Serranus zanana Valenciennes, 1828	*Cephalopholis sexmaculata*
Serranus zananella Valenciennes, 1828	*Cephalopholis sonnerati*
Dermatolepis zanclus Evermann and Kendall, 1900	*Dermatolepis inermis*
Epinephelus zapyrus Seale, 1906	*Epinephelus fasciatus*
Epinephelus zaslavskii Poll, 1949	*Epinephelus costae*

MISSPELLINGS

Alphestes gembra Bloch and Schneider, 1801	(see *Alphestes sambra*)
Holocentrus marginatus Lacepède, 1802	(see *Epinephelus marginalis*)
Epinephelus stellatus Snyder, 1912	(see *Serranus stellans*)
Epinephelus stigmatopomus Seale, 1909	(see *Serranus stigmapomus*)

4. LIST OF SPECIES BY MAJOR FISHING AREAS

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
Aethaloperca rogaa	Aethal 1								●	●	●	●			
Alphestes afer	Alph 1			●			●								
A. immaculatus	Alph 2												●		●
A. multiguttatus	Alph 3												●		
Anyperodon leucogrammicus	Anyper 1								●	●	●	●	●		
Cephalopolis aitha	Cephal 22											●			
C. argus	Cephal 9								●	●	●	●	●	●	
C. aurantia	Cephal 10								●	●	●	●	●		
C. boenak	Cephal 11								●	●	●	●			
C. cruentata	Cephal 4			●											
C. cyanostigma	Cephal 19									●		●			
C. formosa	Cephal 12								●	●	●	●			
C. fulva	Cephal 5			●			●								
C. hemistiktos	Cephal 13								●						
C. igarashiensis	Cephal 20										●	●	●		
C. leopardus	Cephal 14								●	●	●	●	●		
C. microprion	Cephal 21									●		●			
C. miniata	Cephal 1								●	●	●	●	●		
C. nigri	Cephal 6				●			●							
C. oligosticta	Cephal 16								●						
C. panamensis	Cephal 18												●		●
C. polleni	Cephal 23								●	●	●	●	●		
C. sexmaculata	Cephal 17								●	●	●	●	●		

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
C. sonnerati	Cephal 3								●	●	●	●	●		
C. spiloparaea	Cephal 8								●	●	●	●	●	●	
C. taeniops	Cephal 7				●			●							
C. urodeta	Cephal 15								●	●	●	●	●	●	
Cromileptes altivelis	Cromil 1									●	●	●			
Dermatolepis dermatolepis	Dermat 3												●		●
D. inermis	Dermat 1			●			●								
D. striolata	Dermat 2								●						
Epinephelus acanthistius	Epin 59												●		●
E. adscensionis	Epin 13	●		●	●		●	●							
E. aeneus	Epin 3		●		●	●		●							
E. akaara	Epin 66										●				
E. albomarginatus	Epin 26								●						
E. amblycephalus	Epin 74									●	●	●			
E. analogus	Epin 60												●		●
E. andersoni	Epin 27							●	●						
E. areolatus	Epin 4								●	●	●	●			
E. awoara	Epin 5										●				
E. bilobatus	Epin 82									●					
E. bleekeri	Epin 6								●	●	●	●			
E. bontoides	Epin 86										●	●			
E. bruneus	Epin 7										●	●			
E. caeruleopunctatus	Epin 28								●	●	●	●		●	

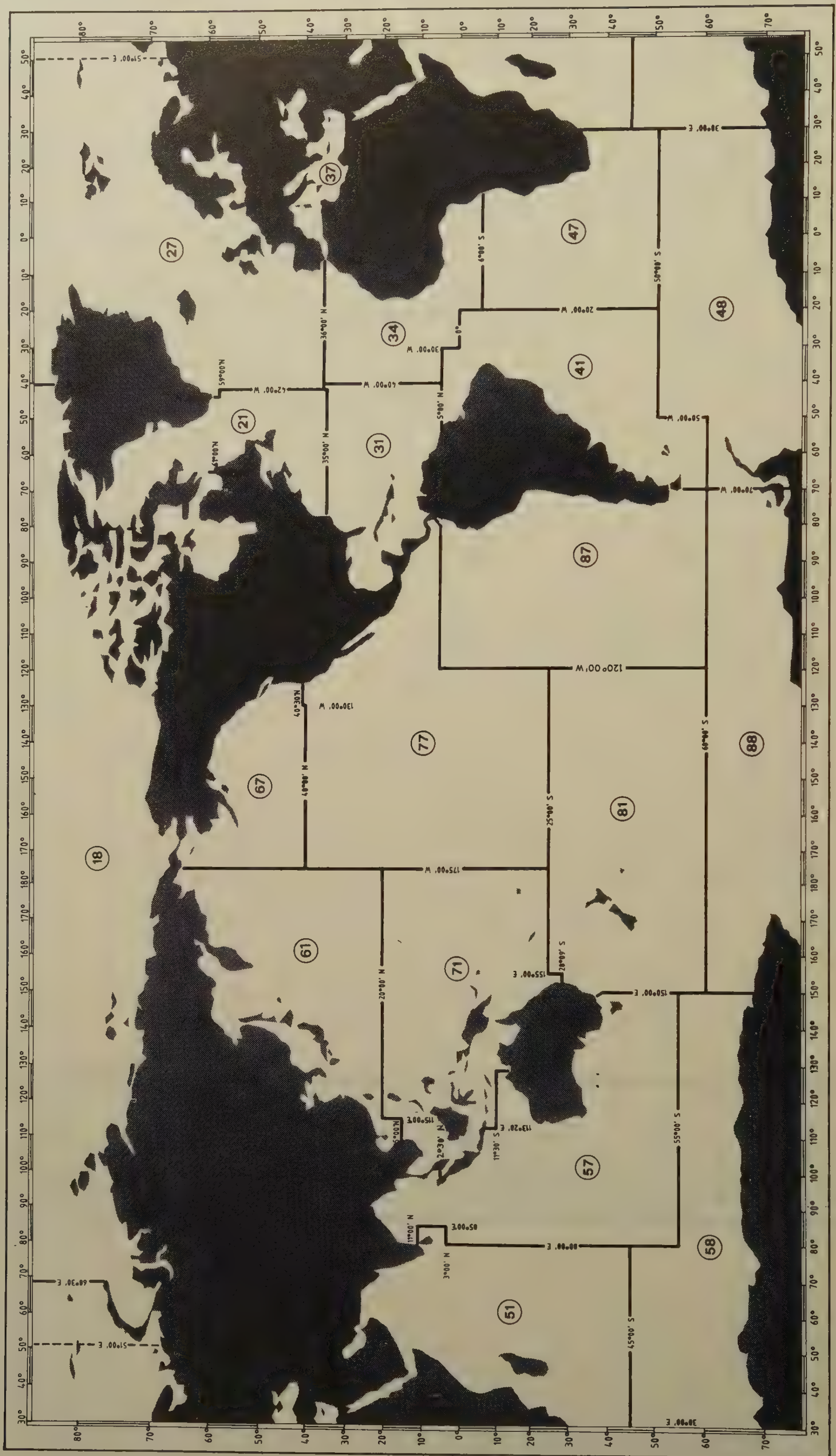
SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
E. caninus	Epin 23		●		●	●		●							
E. chabaudi	Epin 43							●	●						
E. chlorocephalus	Epin 65											●	●		
E. chlorostigma	Epin 29								●	●	●	●	●		
E. cifuentesi	Epin 61												●		●
E. coioides	Epin 67					●			●	●	●	●		●	
E. corallicola	Epin 68									●	●	●		●	
E. costae	Epin 2		●		●	●		●							
E. cyanopodus	Epin 69										●	●		●	
E. daemelii	Epin 70									●		●		●	
E. darwinensis	Epin 71											●			
E. diacanthus	Epin 30								●	●					
E. drummondhayi	Epin 14			●											
E. epistictus	Epin 31								●	●	●	●			
E. ergastularius	Epin 72											●		●	
E. erythrurus	Epin 73								●	●		●			
E. exsul	Epin 62												●		
E. fasciatomaculosus	Epin 75										●	●			
E. fasciatus	Epin 8							●	●	●	●	●	●	●	
E. faveatus	Epin 49								●	●		●			
E. flavocaeruleus	Epin 33							●	●	●					
E. flavolimbatus	Epin 15			●			●								
E. fuscoguttatus	Epin 9								●	●	●	●	●		

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
E. gabriellae	Epin 77								●						
E. goreensis	Epin 25				●			●							
E. guttatus	Epin 16			●											
E. haifensis	Epin 58				●	●		●							
E. heniochus	Epin 78									●	●	●			
E. hexagonatus	Epin 34								●	●	●	●	●	●	
E. howlandi	Epin 79										●	●	●	●	
E. indistinctus	Epin 80								●						
E. irroratus	Epin 81												●		
E. itajara	Epin 17			●	●		●						●		●
E. labriformis	Epin 63												●		●
E. lanceolatus	Epin 83							●	●	●	●	●	●	●	
E. latifasciatus	Epin 35								●	●	●	●			
E. lebretonianus	Epin 84														
E. longispinis	Epin 36								●			●			
E. macrospilos	Epin 32								●	●	●	●	●		
E. maculatus	Epin 85									●	●	●	●	●	
E. magniscuttis	Epin 37								●			●			
E. malabaricus	Epin 38								●	●	●	●	●	●	
E. marginatus	Epin 1		●		●	●	●	●	●						
E. melanostigma	Epin 39								●		●	●	●		
E. merra	Epin 40							●	●	●	●	●	●	●	
E. miliaris	Epin 42								●	●	●	●	●		

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
E. morio	Epin 18			●			●								
E. morrhua	Epin 44								●	●	●	●	●	●	
E. multinotatus	Epin 45								●	●					
E. mystacinus	Epin 19			●											●
E. nigritus	Epin 20	●		●			●								
E. niphobles	Epin 64												●		●
E. niveatus	Epin 21	●		●			●								
E. octofasciatus	Epin 53								●	●		●	●	●	
E. ongus	Epin 46								●	●	●	●			
E. perplexus	Epin 87											●			
E. poecilonotus	Epin 47							●	●	●	●	●			
E. polylepis	Epin 88								●						
E. polyphekadion	Epin 41								●	●	●	●	●	●	
E. polystigma	Epin 89									●		●			
E. posteli	Epin 48								●						
E. quernus	Epin 90												●		
E. quoyanus	Epin 10									●	●	●		●	
E. radiatus	Epin 50								●	●	●	●			
E. retouti	Epin 51								●	●	●	●	●		
E. rivulatus	Epin 52							●	●	●	●	●		●	
E. septemfasciatus	Epin 91										●				
E. sexfasciatus	Epin 92									●	●	●			
E. socialis	Epin 93										●	●	●	●	

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
E. spilotoceps	Epin 54								●	●		●	●		
E. stictus	Epin 94									●	●				
E. stoliczkae	Epin 55								●						
E. striatus	Epin 22			●			●								
E. suborbitalis	Epin 95										●				
E. summana	Epin 11								●						
E. tauvina	Epin 12								●	●	●	●	●	●	
E. timorensis	Epin 96									●		●	●		
E. trimaculatus	Epin 97										●				
E. trophis	Epin 98											●			
E. tuamotuensis	Epin 99												●	●	
E. tukula	Epin 56								●	●	●	●			
E. undulatostriatus	Epin 76									●		●		●	
E. undulosus	Epin 57								●	●	●	●			
Gonioplectrus hispanus	Gonio 1			●			●								
Gracila albomarginata	Gracil 1								●	●	●	●	●		
Mycteroperca acutirostris	Myct 14			●			●								
M. bonaci	Myct 1			●			●								
M. cidi	Myct 2			●											
M. fusca	Myct 15		●		●										
M. interstitialis	Myct 3			●			●								
M. jordani	Myct 9												●		
M. microlepis	Myct 4	●		●			●								

SPECIES	CODE	GEOGRAPHICAL DISTRIBUTION													
		MAJOR FISHING AREAS FOR STATISTICAL PURPOSES													
		21	27	31	34	37	41	47	51	57	61	71	77	81	87
M. olfax	Myct 10												●		●
M. phenax	Myct 5	●		●											
M. prionura	Myct 11												●		
M. rosacea	Myct 12												●		
M. rubra	Myct 6		●		●	●		●							
M. tigris	Myct 7			●			●								
M. venenosa	Myct 8			●			●								
M. xenarcha	Myct 13												●		●
Paranthias colonus	Parant 2												●		●
P. furcifer	Parant 1			●	●		●	●							
Plectropomus areolatus	Plect 2								●	●	●	●	●		
P. laevis	Plect 3								●	●	●	●	●	●	
P. leopardus	Plect 1									●	●	●			
P. maculatus	Plect 4									●		●			
P. oligacanthus	Plect 6									●		●			
P. pessuliferus	Plect 7								●	●		●			
P. punctatus	Plect 5								●						
Saloptia powelli	Salop 1										●	●	●		
Triso dermopterus	Triso 1									●	●				
Variola albimarginata	Vari 2								●	●	●	●	●		
V. louti	Vari 1								●	●	●	●	●	●	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6. INDEX OF SCIENTIFIC AND VERNACULAR NAMES

EXPLANATION OF THE SYSTEM

Type faces used:

Italics (bold)	:	Valid scientific names (double entry by genera and species)
Italics	:	Synonyms (double entry by genera and species)
Roman (bold)	:	International (FAO) species names
Roman	:	Local species names

A

Abade 265
Abadèch 135
Abadejo 265
Abadejo 267
Abae 265
abdominalis, Serranus 174
acanthistius, Bodianus 69-70, 102
acanthistius, Cephalopholis 102
acanthistius, Epinephelus 26, 53, 69-70, 102-103, 174
acutirostris, Mycteroperca 256, 261-262, 276
acutirostris, Serranus 256, 261, 266
adscensionis, Epinephelus 40, 53, 103-104, 162, 196
adscensionis, Trachinus 103
aeneus, Epinephelus 69, 104-106
aeneus, Serranus 104
Aethaloperca 11, 16-17
Aethaloperca rogaa 16
afer, Alphestes 18, 20-23
afer, Epinephelus 18, 20, 22
African hind 60
Agnato 60
Aguaji 104
aguaji, Trisotropis 262
aitha, Cephalopholis 26, 33
aka-ara, Serranus 106
Aka-madarahata 158
akaara, Epinephelus 1, 3-4, 106-107, 150
Akahana 59
Akahata 151
Akahata-modok 225
Ako 166
alatus, Serranus 220
albimaculatus, Epinephelus 117
albimarginata, Variola 302-305
albo-fuscus, Holocentrus 181
alboguttatus, Serranus 120
albomarginata, Gracila 55, 254-255
albomarginatus, Cephalopholis 254
albomarginatus, Epinephelus 108
albopunctulatus, Epinephelus 169
aldabrensis, Dermatolepis 68
alexandrinus, Epinephelus 123, 134-136, 266
alexandrinus, Serranus 135, 150
Alovo 35, 50, 58, 68
Alphestes 11, 18, 26, 65, 70, 286
Alphestes afer 18, 20-23
Alphestes fasciatus 21-22
Alphestes galapagensis 21-22
Alphestes immaculatus 18, 21-23
Alphestes multiguttatus 18, 22
Alphestes scholanderi 204, 205
Altiserranus 69
Altiserranus woorei 300
altivelioides, Serranus 132
altivelis, Cromileptes 4, 63-64
altivelis, Serranus 63
amblycephalus, Epinephelus 109-110
amblycephalus, Serranus 109
amboinensis, Serranus 250
Anak keretang 110
Anak pertang 110
analis, Cephalopholis 36, 58-59
analis, Serranus 35
analogus, Epinephelus 53, 69, 103, 110, 148, 174
andersoni, Epinephelus 111-112
angularis, Serranus 112
angustifrons, Serranus 195
Anthias cherna 236
Anthias striatus 236
Anyperodon 11, 23, 25
Anyperodon leucogrammicus 23
Aohata 115
Aohata-modoki 235
Aonomehata 35
Aosujihata 43
Apia 231
apiarius, Serranus 38
apua, Bodianus 278
Ara, Serranus 244
arara, Bonaci 262
arara, Serranus 161, 262
Archoperca 256
areolata, Perca 112
Areolate grouper 112
areolatum, Plectropoma 289
areolatus japonicus, Serranus 127
areolatus, Epinephelus 69, 112-113
areolatus, Plectropomus 289-290
argus, Cephalopholis 25-26, 34-35, 41, 55
Arhani 106
Arigua 279
armatus, Serranus 275
aspersus, Serranus 186
assabensis, Serranus 127
Ata'ata-utu 290, 293
Atara 231
aurantia, Cephalopholis 26, 35-36, 58-59
aurantius, Cephalopholis 57
aurantius, Serranus 35
auratus, Holocentrus 43
australis, Serranus 216
awo-ara, Serranus 114
awoara, Epinephelus 114-115
Awro 188

B

Babonne 292
Bachungor 56
Badèche 135
Badèche baillou 269
Badèche blanche 264
Badèche bonaci 262
Badèche créole 284

Badèche de roche 278
Badèche du Pacifique 283
Badèche galopin 271
Badèche gueule jaune 266
Badèche peigne 261
Badèche rouge 275
Badèche tigre 277
Badèches 11
Badejo 265
Badejo-da-areia 270
Badejo-mira 262
Badejo-quadrado 263
Bades 106
Balala 25
Balang 230
Balong 118
Balufana 35
Bandama 56
Banded grouper 109
Banded rockcod 145
Banded-tail coral-cod 62
Bandera 11
Bandera español 252
Baqueta 102
Bara-hata 305
Barber 285
Barramundi cod 64
Barred-chest grouper 152
bataviensis, Serranus 208
Batrachus gigas 69, 174
Biajaiba 253
Bigspot grouper 179
bilobatus, Epinephelus 115-116, 153, 166, 181-182, 190, 192, 221, 233
Black grouper 262
Black rockcod 139
Black-dotted grouper 234
Black-saddled grouper 245
Black-spotted grouper 144
Black-spotted rockcod 144
Black-tipped rockcod 151
Blacksaddle grouper 167
Blacksaddled coralgrouper 290
Blacksaddled coraltrout 290
Blacktip grouper 150
Bleeker's grouper 118
bleekeri, Epinephelus 117-118, 150, 244
Bleekeri, Serranus 117-118
Blue Maori 137
Blue-and-yellow grouper 154
Blue-lined coraltrout 295
Blue-lined grouper 55
Blue-spotted rockcod 50
Bluedotted coraltrout 292
Bluelined hind 42
Bluespotted hind 40
Bluespotted rock cod 41
Bluespotted seabass 60
Bodianus 69
Bodianus acanthistius 69-70, 102
Bodianus apua 278
Bodianus boenak 37
Bodianus cyclostomus 290
Bodianus guativere 43
Bodianus guttatus 34
Bodianus indelebilis 35
Bodianus jacob-evertsen 34
Bodianus macrocephalus 154
Bodianus maculatus 285, 293
Bodianus marginatus 278
Bodianus melanoleucus 290
Bodianus melanurus 112
Bodianus stellatus 38
Bodianus undulosus 250, 261
boelang, Serranus 37-38
boenak, Bodianus 37
boenak, Cephalopholis 26, 37-38, 42-43, 49
Bogi 294
Bola? coioides 130
Bonaci 263
Bonaci arara 262
Bonaci cardenal 278
Bonaci cardenal 279
Bonaci de piedra 279
Bonaci gato 278
bonaci, Mycteroperca 262-263, 270, 278-279
bonaci, Serranus 262
bonaci variety *xanthosticta, Mycteroperca 262*
boninius, Cephalopholis 49
bontoides, Epinephelus 118-119
bontoides, Serranus 118
Bontoo 43, 58, 185
bontoo, Serranus 152
borbonicus, Serranus 154
boulengeri, Mycteroperca 256, 280
bowersi, Mycteroperca 278
Brachyrhinus 281
brachysoma, Epinephelus 186, 188
Bridled grouper 164
Brindle bass 175
Broken-line grouper 143
Broomtail grouper 280
Brown coral cod 38
Brown rockcod 144
Brown-marbled grouper 157
Brownback grouper 224
Brownspotted grouper 127
bruneus, Epinephelus 69, 119-120, 169, 218
brunneus, Serranus 262
Bulang 47
burdi, Pomacentrus 49
Burtam 177

C

Cabot aux yeux vert 183
Cabot de fond 183
Cabot grosse écaille 183
Cabot noir 197
Cabot sale 227
Cabrilla 161
Cabrilla calamaria 275
Cabrilla de astillero 268
Cabrilla morja 162
Cabrilla piedrera 173
Cabrilla pinta 173
Cabrilla pintita 275
Cabrilla sardinera 274
Cabrilla venda 109
Cachorro 123
caeruleo-punctatus, Holocentrus 120
caeruleopunctatus, Epinephelus 120-122, 133, 209, 217, 240
Calico grouper 143
calliura, Mycteroperca 266
camelopardalis, Serranus 276
Camouflage grouper 214
Canario 44
caninus, Epinephelus 122-123, 160
caninus, Serranus 122
capreolus, Serranus 103
Captain Fine 108, 112
carauna, Serranus 43
cardenal, Bonaci 278
cardinalis, Serranus 278
Carite 175
carniatus, Serranus 220
castelnaui, Serranus 284
catalonica, Cerna 134
Catface grouper 111
Catface rockcod 112
catus, Serranus 40, 161
celebicus variety *multipunctatus, Serranus 127*
celebicus, Serranus 112
Centropristes nebulosus 284
Centropristis merus 201
Cephalopholis 11, 16, 25-26, 45, 55, 60, 70, 103, 256, 286
Cephalopholis acanthistius 102
Cephalopholis aitha 26, 33
Cephalopholis albomarginatus 254
Cephalopholis analis 36, 58-59
Cephalopholis argus 25-26, 34-35, 41, 55
Cephalopholis aurantia 26, 35-36, 58-59
Cephalopholis aurantius 57
Cephalopholis boenak 26, 37-38, 42-43, 49
Cephalopholis boninius 49
Cephalopholis coatesi 55
Cephalopholis cruentata 25-26, 38-39
Cephalopholis cyanostigma 26, 35, 40-41
Cephalopholis formosa 26, 38, 42-43
Cephalopholis formosanus 49, 57
Cephalopholis fulva 25-26, 43-44
Cephalopholis gibbus 55
Cephalopholis hemistiktos 26, 44-46, 50, 62
Cephalopholis igarashiensis 25-26, 46-47
Cephalopholis kendalli 40
Cephalopholis leopardus 26, 47-48
Cephalopholis maculatus 49
Cephalopholis microprion 26, 48-49
Cephalopholis miniata 26, 41, 45, 49-50, 52
Cephalopholis miniatus 45, 56
Cephalopholis nigri 26, 51
Cephalopholis nigripinnis 36, 61
Cephalopholis obtusauris 35
Cephalopholis oligosticta 26, 52
Cephalopholis pachycentron 38, 49
Cephalopholis panamensis 26, 39, 53, 103, 174
Cephalopholis polleni 25-26, 42, 54-55
Cephalopholis popino 102
Cephalopholis purpureus 57
Cephalopholis rogaa 16
Cephalopholis sexmaculata 26, 45, 55-56
Cephalopholis sonnerati 25-26, 36, 57-58
Cephalopholis spiloparaea 26, 36, 58-59
Cephalopholis swanius 46
Cephalopholis taeniops 26, 60
Cephalopholis urodeta 26, 57, 61-62
Cephalopholis virgatus 54
Cephalopholis xanthoptera 40-41
Cerna 69
Cerna catalonica 134
Cerna gigas 188
Cerna macrogenis 275
Cerna sicana 162-163
Cernia bronzina 106
Cernia bruna 188
Cernia dorata 135
Cernia nera 123
cernioides, Serranus 186
cernipedis, Serranus 304
Cernua 69
chabaudi, Epinephelus 124-125, 189
Chabaudi, Serranus 124
Chai-may-tsee-mah-paan 113
Chairomaruhata 132
chalinius, Epinephelus 261
Chammam 158
Charcoal belly 270
Chencheerachammam 58
Cherna 172
Cherna alinegra 61
Cherna americana 196
Cherna arábiga 44
Cherna arlequin 54
Cherna cabrilla 43
Cherna chillona 46
Cherna chocolate 37

Cherna colorada 60
Cherna criolla 236
Cherna de pintas azules 40
Cherna de seis manchas 55
Cherna de vivero 196
Cherna del alto 156, 201
Cherna del Mar Rojo 52
Cherna del Niger 51
Cherna dorada 35
Cherna enjambre 38
Cherna estrellada 49
Cherna de ley 105
Cherna frutillera 59
Cherna herrumbrosa 33
Cherna jaspeada 67
Cherna leopardo 47
Cherna manchada 206
Cherna pavo real 34
Cherna pecosa 48
Cherna piña 57
Cherna pintada 205
Cherna pintada 206
Cherna rayada 42
Cherna roga 16
cherna, Anthias 236
Chernas 11
Cherne 123, 172, 206
Cherne de ley 106
Cherne dentón 122
Cherne ley 123
Cheung-gig-paan 182
Cheung-may-paan 305
Cheung-pei-paan 235
Cheval du bois 25
Chewa 17, 25, 35
chewa, Epinephelus 185, 241
Chi hou 132
Chi hou 118
Chinaman rockcod 227
Chinese footballer 292
Ching-paan 120
chlorocephalus, Epinephelus ***126-127***
chlorocephalus, Serranus 126
chloropterum, Plectropoma 18, 20
chlorostigma, Epinephelus ***113, 127-128, 159, 213-214***
chlorostigma, Serranus 127
chlorostomus, Trisotropis 266
Chocolate hind 37
Choloteachl 25
Chromileptes 63
chrysomelas, Sparus 236
chrysotaenia, Serranus 134
Chubei 17
cidi, Mycteroperca ***188, 263-264, 267, 279***
cifuentesi, Epinephelus ***129-130, 204***
clarkei, Epinephelus 124-125
Cloudy grouper 146
coatesi, Cephalopholis 55
coioides, Bola? 130
coioides, Epinephelus ***4, 69-70, 130-132, 147, 172, 185-186, 242***
colonus, Paranthias ***282-283, 285***
colonus, Serranus 283
Colorado grouper 271
Comb grouper 261
Comb grouper 275
Comet grouper 196
cometae, Epinephelus 196-197, 223
compressus, Epinephelus 206-207
Coné bande 53
Coné essaim 38
Coné ouatalibi 43
Coney 43
conspersus, Serranus 204
Convict grouper 201
Convict grouper 227
Coral cod 50, 294
Coral grouper 132
Coral hind 49
Coral rockcod 50, 133
Coral trout 50, 292-294
Coralgroupers 11
corallicola, Epinephelus ***121-122, 132-133, 167-168, 179, 181***
corallicola, Serranus 132
Coromandelicus, Serranus 117-118
Coronation trout 305
coronatus, Serranus 38
Corruncha 44
Corvina oxyptera 284
costae, Epinephelus ***123, 134-136, 160, 266***
courtadei, Serranus 110
crapao, Serranus 184
craspedurus, Epinephelus 112
Creole-fish 284
Creole-fishes 11
Creolus 281
creolus, Serranus 281, 284
Croissant queue blanche 303
Croissant queue blanche 304
Croissant queue jaune 304
Croissant queue jaune 305
Croissant queues 11
Cromileptes ***11, 63-64***
Cromileptes altivelis ***4, 63-64***
cruentata, Cephalopholis ***25-26, 38-39***
cruentatus, Epinephelus 38
cruentatus, Petrometopon 38
cruentatus, Sparus 38
cruentus, Serranus 150
cubanus, Epinephelus 161
Cuna aguají 269
Cuna amarilla 266
Cuna blanca 264
Cuna bonací 262
Cuna cabrilla 39

Cuna chulinga 267
Cuna cucaracha 279
Cuna de piedra 278
Cuna garopa 271
Cuna garopa 272
Cuna gata 277
Cuna guarei 263
Cuna lucero 284
Cuna negra 261
Cuna negra 262
Cuna raba rajao 267
Cuna rabo rajao 264
Cunaro de piedra 285
Cunas 11
Cuvieri, Epinephelus 261
cyanopodus, Epinephelus 136-137, 155, 199
cyanostigma, Cephalopholis 26, 35, 40-41
cyanostigma, Plectropoma 292
cyanostigma, Serranus 40
cyanostigmatoides, Serranus 49
cyclopomatus, Serranus 262
cyclostomus, Bodianus 290
cylindricus, Epinephelus 184
cylindricus, Serranus 179
Cynichthys 69
Cynichthys flavo-purpuratus 69, 154

D

Dadassou ekoué 106
daemelii, Epinephelus 138-139
Daggar mazury 106
Dämelii, Serranus 138
Darkfin hind 61
Darwin grouper 139
darwinensis, Epinephelus 139
Dayi, Epinephelus 117, 140
decimalis, Serranus 262
Dermatolepis 11, 26, 64-65, 70, 286
Dermatolepis aldabrensis 68
Dermatolepis dermatolepis 64-66, 68
Dermatolepis inermis 65-68
Dermatolepis marmoratus 66
Dermatolepis punctatus 64-65
Dermatolepis striolata 65, 68
Dermatolepis zanclus 66
dermatolepis, Dermatolepis 64-66, 68
dermatolepis, Epinephelus 65
dermochirus, Serranus 120
dermopterus, Serranus 300
dermopterus, Triso 300-301
diacanthus, Epinephelus 117, 140-141, 149, 230, 234-235
Dialakh 188
Dicentrarchus 286
dichropterus, Serranus 208
dictiophorus, Epinephelus 193-194
diktiophorus, Serranus 193
dimidiatus, Serranus 266
dispar variety A. *Serranus 248*
dispar variety B. *Serranus 114*
dispar, Epinephelus 215
dispar, Serranus 214
ditobo, Promicrops 171
döderleinii, Epinephelus 222
Dogtooth grouper 122
Doï 160
Dojh 60
Donaquira 60
Dot-dash grouper 211
Dotted grouper 143
Doy 135
Drummond-Hayi, Epinephelus 142
drummondhayi, Epinephelus 142-143
dubius, Serranus 26
Dungat grouper 159
Dusky grouper 186, 189
Duskyfin hind 61
Duskytail grouper 117

E

Eightbar grouper 207
Elewik 48
elongatus, Epinephelus 241
emarginatus, Serranus 265-266
emoryi, Epinephelus 150
Enjambre 39
Enjambre 53
Enneacentrus 25
Enneistus 69, 103
Epaulet grouper 235
Epinephelus 11, 18, 23, 26, 34, 65, 69-70, 103, 130, 134, 148, 160-161, 172, 175, 187-188, 196, 251, 256,261, 276, 286
Epinephelus acanthistius 26, 53, 69-70, 102-103, 174
Epinephelus adscensionis 40, 53, 103-104, 162, 196
Epinephelus aeneus 69, 104-106
Epinephelus afer 18, 20, 22
Epinephelus akaara 1, 3-4, 106-107, 150
Epinephelus albimaculatus 117
Epinephelus albomarginatus 108
Epinephelus albopunctulatus 169
Epinephelus alexandrinus 123, 134-136, 266
Epinephelus amblycephalus 109-110
Epinephelus analogus 53, 69, 103, 110, 148, 174
Epinephelus andersoni 111-112
Epinephelus areolatus 69, 112-113
Epinephelus awoara 114-115
Epinephelus bilobatus 115-116, 153, 166, 181-182, 190, 192, 221, 233
Epinephelus bleekeri 117-118, 150, 244
Epinephelus bontoides 118-119
Epinephelus brachysoma 186, 188
Epinephelus bruneus 69, 119-120, 169, 218

Epinephelus caeruleopunctatus ***120-122, 133, 209, 217, 240***
Epinephelus caninus ***122-123, 160***
Epinephelus chabaudi ***124-125, 189***
Epinephelus chalinius *261*
Epinephelus chewa *185, 241*
Epinephelus chlorocephalus ***126-127***
Epinephelus chlorostigma . ***113, 127-128, 159, 213-214***
Epinephelus cifuentesi ***129-130, 204***
Epinephelus clarkei *124-125*
Epinephelus coioides ***4, 69-70, 130-132, 147, 172, 185, 242***
Epinephelus cometae *196-197, 223*
Epinephelus compressus *206-207*
Epinephelus corallicola ***121-122, 132-133, 167-168, 179, 181***
Epinephelus costae ***123, 134-136, 160, 266***
Epinephelus craspedurus *112*
Epinephelus cruentatus *38*
Epinephelus cubanus *161*
Epinephelus Cuvieri *261*
Epinephelus cyanopodus ***136-137, 155, 199***
Epinephelus cylindricus *184*
Epinephelus daemelii ***138-139***
Epinephelus darwinensis ***139***
Epinephelus Dayi *117,140*
Epinephelus dermatolepis *65*
Epinephelus diacanthus ***117, 140-141, 149, 230, 234-235***
Epinephelus dictiophorus *193-194*
Epinephelus dispar *215*
Epinephelus döderleinii *222*
Epinephelus Drummond-Hayi *142*
Epinephelus drummondhayi ***142-143***
Epinephelus elongatus *241*
Epinephelus emoryi *150*
Epinephelus epistictus ***143-144, 165, 177, 183***
Epinephelus ergastularius ***145-146, 208, 228***
Epinephelus erythrurus ***146-147***
Epinephelus esonue *171*
Epinephelus exsul ***69, 130, 147-148, 202, 204***
Epinephelus fario *178, 244-245*
Epinephelus fasciatomaculosus . . ***107, 141, 148-150***
Epinephelus fasciatus . . . ***69, 135, 150-152, 225, 227***
Epinephelus faveatus . . ***116, 152-153, 166, 179-182, 190, 192, 221, 233***
Epinephelus flavocaeruleus ***69, 137, 154-155, 199, 246***
Epinephelus flavolimbatus ***155-156, 206***
Epinephelus formosus *42*
Epinephelus forsythi *138*
Epinephelus fuscoguttatus . . ***156-158, 194, 215, 242***
Epinephelus fuscus *193-194*
Epinephelus gabriellae ***128, 158-159, 214***
Epinephelus gaimardi *178*
Epinephelus gigas *163, 186, 188*
Epinephelus goreensis ***123, 136, 159-160, 189***
Epinephelus grammatophorus *225*
Epinephelus guaza *1, 106, 163, 186-189*
Epinephelus guttatus ***40, 161-162, 262***
Epinephelus haifensis ***123, 162-163, 187-189***
Epinephelus hata *164*
Epinephelus heniochus ***143-144, 164-165***
Epinephelus hexagonatus ***116, 153, 165-166, 181-182, 190, 193, 218, 221, 233***
Epinephelus homosinensis *225*
Epinephelus howlandi ***133, 167-168, 179, 181***
Epinephelus indistinctus ***168-169***
Epinephelus inermis *66*
Epinephelus ionthas *106*
Epinephelus irroratus ***152, 169-170, 225, 227***
Epinephelus itajara ***69-70, 171-172, 175***
Epinephelus janthinopterus *57*
Epinephelus jordani *268*
Epinephelus kohleri *136*
Epinephelus labriformis ***53-54, 103, 173-174***
Epinephelus lanceolatus ***69, 172, 174-175, 185, 210, 242***
Epinephelus latifasciatus ***69, 144, 176***
Epinephelus lebretonianus ***177***
Epinephelus leprosus *198-199*
Epinephelus lightfooti *20*
Epinephelus lobotoides *106*
Epinephelus longispinis ***178-179, 182***
Epinephelus macrospilos . . . ***116, 133, 153, 166-168, 179-180, 182, 190, 193, 221, 233, 242***
Epinephelus maculatus ***116, 153, 167, 178-179, 181-182, 190, 193-194, 222, 233***
Epinephelus magniscuttis ***143, 182-184, 223***
Epinephelus malabaricus ***4, 70, 131-132, 172, 184-185, 242***
Epinephelus marginalis *69, 150, 186*
Epinephelus marginatus ***106, 123, 125, 136, 160, 163, 186-189, 264, 266***
Epinephelus matterni *225*
Epinephelus mauritianus *224*
Epinephelus megachir *221*
Epinephelus melanostigma ***116, 153, 167, 181-182, 189-191, 193, 222, 233, 242***
Epinephelus merra ***116, 153, 167, 181-182, 190-192, 221-222, 233***
Epinephelus microdon *158, 215*
Epinephelus miliaris ***178, 193-194***
Epinephelus miltostigma *35*
Epinephelus moara *120*
Epinephelus modestus *124-125*
Epinephelus morio ***104, 188, 195-196***
Epinephelus morrhua ***125, 196-198, 211-212, 222-223, 247***
Epinephelus multiguttatus *22*
Epinephelus multinotatus . ***58, 69, 137, 155, 198-199***
Epinephelus mystacinus . ***70, 200-201, 206, 208, 228***
Epinephelus nebulosus *147*
Epinephelus nigripinnis *62*
Epinephelus nigritus ***69, 148, 163, 201-202***
Epinephelus niphobles ***130, 203-204, 206, 219***
Epinephelus niveatus . . . ***69, 103, 156, 202, 204, 206***
Epinephelus octofasciatus . . ***146, 201, 206-208, 228***

Epinephelus ongus ***122, 208-209, 231, 240***
Epinephelus ordinatus *173*
Epinephelus panamensis *53*
Epinephelus perplexus ***210-211***
Epinephelus peruanus *203-204*
Epinephelus Playfayri *61*
Epinephelus poecilonotus ***198, 211-212, 247***
Epinephelus polleni *54*
Epinephelus polylepis ***128, 159, 213-214***
Epinephelus polyphekadion ***158, 194, 214-215, 242***
Epinephelus polystigma ***216-217***
Epinephelus posteli ***217-218***
Epinephelus praeopercularis *212*
Epinephelus pseudomorrhua *182, 184*
Epinephelus quernus ***218-219***
Epinephelus quoyanus ***116, 153, 167, 179-182, 190, 193, 220-221, 233***
Epinephelus radiatus ***197-198, 212, 222-223, 247***
Epinephelus rahanus *216*
Epinephelus rankini *198*
Epinephelus raymondi *225*
Epinephelus retouti ***152, 224-225, 227***
Epinephelus Retouti *224*
Epinephelus rivulatus ***141, 152, 225-227, 236***
Epinephelus rosaceus *274*
Epinephelus ruber *275-276*
Epinephelus rubra *224*
Epinephelus salonotus *232, 242*
Epinephelus sellicauda *173*
Epinephelus septemfasciatus ***3-4, 125, 146, 201, 206-208, 227-228***
Epinephelus sexfasciatus ***141, 229-230***
Epinephelus sicana *163*
Epinephelus slacksmithi *208*
Epinephelus socialis ***230-231***
Epinephelus sp. *143, 158, 193, 198, 213, 238, 243*
Epinephelus sp.- A1 *134*
Epinephelus sp.- A2 *134*
Epinephelus sp.- B1 *123*
Epinephelus spilotoceps ***116, 133, 153, 166-167, 181-182, 190, 193, 222, 232-233, 242***
Epinephelus spilotus *167*
Epinephelus spiramen *225*
Epinephelus stictus ***69, 141, 234-235***
Epinephelus stigmogrammacus *143*
Epinephelus stoliczkae ***235-236***
Epinephelus striatus ***1, 4, 43, 236-238***
Epinephelus suborbitalis ***238-239***
Epinephelus suillus *132, 185*
Epinephelus suitonis *136*
Epinephelus summana ***121-122, 125, 209, 239-240***
Epinephelus summana hostiaretis *208*
Epinephelus tauvina ***1, 131-132, 180, 185-186, 190-191, 241-242***
Epinephelus thompsoni *210*
Epinephelus timorensis ***243-244***
Epinephelus Townsendi *146*
Epinephelus trimaculatus ***115, 244-245***
Epinephelus trophis ***155, 245-246***
Epinephelus truncatus *224, 300*
Epinephelus tuamotuensis ***198, 212, 246-247***
Epinephelus tukula ***248-249***
Epinephelus undulatostriatus ***249-250***
Epinephelus undulosus ***1, 69, 250-251***
Epinephelus urodelops *47*
Epinephelus zapyrus *150*
Epinephelus zaslavskii *134-136*
epistictus, Epinephelus ***143-144, 165, 177, 183***
epistictus, Serranus *143*
ergastularius, Epinephelus ***145-146, 208, 228***
erythraeus, Holocentrus *150*
erythraeus, Serranus *61*
erythrogaster, Serranus *195*
erythrurus, Epinephelus ***146-147***
esonue, Epinephelus *171*
esonue, Promicrops *171*
estuarius, Serranus *184*
Estuary grouper 132
exsul, Epinephelus *69, 130, 147-148, 202, 204*
exsul, Serrihastaperca *69, 147-148*

F

Fah-gau-paan 221
Fah-paan 132
Fah-tau-mui 221
falcata variety *phenax, Mycteroperca* *271*
falcatus, Serranus *266*
Falso abadejo **134**
Fana 158
fario, Epinephelus *178, 244-245*
fario, Perca *245*
Faroa 242
fasciatomaculatus, Epinephelus *148*
fasciata, Perca *134, 150*
fasciatomaculosus, Epinephelus ***107, 141, 148-150***
fasciatomaculosus, Serranus *148*
fasciatus, Alphestes *21-22*
fasciatus, Epinephelus ***69, 135, 150-152, 225, 227***
fasciatus, Plectropoma *134*
faveatus, Epinephelus ***116, 152-153, 166, 179-182, 190, 192, 221, 233***
faveatus, Serranus *152*
felinus, Serranus *276*
fimbriatus, Serranus *186*
Fistularia *26*
Flag cabrilla 173
Flag-tailed grouper 62
Flag-tailed rockcod 62
Flagtail grouper 62
flava-purpurea, Perca *69, 154*
flavicauda, Hyporthodus *69, 204*
flavimarginatus, Serranus *304*
flavo-cacruleus, Holocentrus *154*
flavo-purpuratus, Cynichthys *69, 154*
flavocaeruleus, Epinephelus ***69, 137, 154-155, 199, 246***

flavoguttatus, Serranus *120*
flavolimbatus, Epinephelus ***155-156, 206***
Flowery cod 158
Footballer cod 151
Footballer trout 292
formosa, Cephalopholis ***26, 38, 42-43***
formosa, Sciaena *42*
formosanus, Cephalopholis *49, 57*
formosus, Epinephelus *42*
forskael, Holocentrus *150*
forsythi, Epinephelus *138*
Foursaddle grouper **232**
Freckled hind **48**
Freckled rock cod 56
Frostback rockcod 116
Fullichammam 179
fulva, Cephalopholis ***25-26, 43-44***
fulvus, Labrus *43*
furcifer, Paranthias ***26, 44, 281-285***
furcifer, Serranus *281, 284*
fusca, Mycteroperca ***135-136, 256, 261-262, 265-266, 276***
fusco-guttata, Perca summana variety *156*
fuscoguttatus, Epinephelus ***156-158, 194, 215, 242***
fuscus, Epinephelus *193-194*
fuscus, Labrus *188*
fuscus, Serranus *265-266*

G

gabriellae, Epinephelus ***128, 158-159, 214***
Gag **269**
Gag 278
gaimardi, Epinephelus *178*
Gaimardi, Serranus *193*
galapagensis, Alphestes *21-22*
galeus, Serranus *171*
Gallina **129**
Gallina 130
Gaot 230
Garaupa 195
Garea 231
Garish hind **46**
Garlopa 268
Garopa 158
Garopa petto 160
Garoupa 58, 188
Garoupa amarela 135
Garoupa encarnada 60
Garoupa verde 106
Garoupa-de-pintas 60
Garoupa-de-São Tomé 196
Garoupa-gato 20
Garoupa-pintada 104
Garoupa-verdadeira 188
Garropa aserrada **273**
Garropa parda **270**
Garrupa *69*
Gatow 113
Geoffroyi, Serranus *127*
geographicus, Serranus *174*
geometricus, Serranus *150*
Giant coraltrout 292
Giant grouper 171
Giant grouper **174**
gibbosus, Serranus *68*
gibbus, Cephalopholis *55*
gigas, Batrachus *69, 174*
gigas, Cerna *188*
gigas, Epinephelus *163, 186, 188-189*
gigas, Perca *69, 162-163*
gigas, Serranus *188-189*
Gilberti, Serranus *220*
Gitano **275**
glaucus, Serranus *112*
Gobra 141, 185, 251
Goldblotch grouper **134**
Golden grouper 275
Golden grouper **299**
Golden hind **35**
Goldiei, Serranus *241*
Goldmanni, Serranus *214*
Goliath, Oligorus *174*
Gonioplectrus ***11, 252-253, 286***
Gonioplectrus hispanus ***18, 252***
goreensis, Epinephelus ***123, 136, 159-160, 189***
goreensis, Serranus *135, 159*
Gracila ***11, 16, 55, 254***
Gracila albomarginata ***55, 254-255***
Gracila okinawae *54*
grammatophorus, Epinephelus *225*
grammicus, Serranus *176*
Grand queue 305
Graysby **38-39**
Greasy grouper 185
Greasy grouper **241**
Groper 175
Grouper 104
Groupers **11**
Guasa 172
guasa, Serranus *69, 171*
Guaseta **20**
Guaseta 22
Guaseta pacifico **21**
Guaseta rayado **22**
Guasetas **11**
Guativere 44
guativere, Bodianus *43*
guaza, Epinephelus *1, 106, 163, 186-189*
Guaza, Labrus *188, 264, 266*
guaza, Serranus *189*
Guitongue 58
Gulf coney 102
Gulf grouper **268**
Gum-chin-paan 221
Guntheri, Homalogrystes *69, 130*

guttata, Perca . . . *34, 38, 161*
guttatus, Bodianus . . . *34*
guttatus, Epinephelus . . . ***40, 161-162, 262***
guttatus, Johnius . . . *256, 278*
guttatus, Perca . . . *25, 38*
guttatus, Serranus . . . *25*
guttulatus, Serranus . . . *249*
Gvaza, Labrus . . . *188*
gvaza, Labrus . . . *188, 264, 266*
Gymnocephalus ruber . . . 43
gymnopareius, Serranus . . . *236*
gymnosus, Holocentrus . . . *154*

H

Haifa grouper . . . **162, 189**
haifensis, Epinephelus . . . ***123, 162-163, 187-189***
Hakuten-hata . . . 122
Halfmoon grouper . . . **226**
Halichoeres purpurescens . . . *25*
Hamoor . . . 132
Hana-hata . . . 36
Haoa . . . 215
Hapuku . . . 215, 231
Hapuu . . . 215
Hapuupuu . . . 219
Harlequin hind . . . **54**
Haroa . . . 242
hata, Epinephelus . . . *164*
Hawaiian grouper . . . **218**
Hekaru . . . 141, 185, 251
hemistiktos, Cephalopholis . . . ***26, 44-46, 50, 62***
hemistiktos, Serranus . . . *44*
heniochus, Epinephelus . . . ***143-144, 164-165***
hexagonatus, Epinephelus . . . ***116, 153, 165-166, 181-182, 190, 193, 218, 221, 233***
hexagonatus, Holocentrus . . . *165*
Highfin coralgrouper . . . **295**
Highfin grouper . . . **181**
Hinds . . . **11**
Hiregurohata . . . 168
hispanum, Plectropoma . . . *252*
hispanus, Gonioplectrus . . . ***18, 252***
Ho'a . . . 305
Hoedtii, Serranus . . . *136*
Hoevenii, Serranus . . . *120*
Hohosujihata . . . 165
Hôkihata . . . 197
Holocentrus albo-fuscus . . . *181*
Holocentrus auratus . . . *43*
Holocentrus caeruleo-punctatus . . . *120*
Holocentrus erythraeus . . . *150*
Holocentrus flavo-caeruleus . . . *154*
Holocentrus forskael . . . *150*
Holocentrus gymnosus . . . *154*
Holocentrus hexagonatus . . . *165*
Holocentrus lanceolatus . . . *174*
Holocentrus leopardus . . . *285, 292*
Holocentrus maculatus . . . *181*
Holocentrus malabaricus . . . *184*
Holocentrus marginatus . . . *150, 186*
Holocentrus oceanicus . . . *150*
Holocentrus Ongus . . . *208*
Holocentrus pantherinus . . . *241*
Holocentrus punctatus . . . *65, 161*
Holocentrus rosmarus . . . *150*
Holocentrus salmoïdes . . . *184*
Homalogrystes . . . *69*
Homalogrystes Guntheri . . . *69, 130*
Homalogrystes luctuosus . . . *136*
homfrayi, Serranus . . . *47*
homosinensis, Epinephelus . . . *225*
Honeycomb cod . . . 192
Honeycomb grouper . . . **191**
Honeycomb grouper . . . 220
Honeycomb rockcod . . . 192
Honeyfin grouper . . . 193
Hong Kong grouper . . . **106**
Hoosekihata-modoki . . . 194
hopkinsi, Mycteroperca . . . *276*
horridus, Serranus . . . *156*
Hôsekihata . . . 128
howlandi, Epinephelus . . . ***133, 167-168, 179, 181***
howlandi, Serranus . . . *167-168*
Hua dun hou . . . 185
Hua hou . . . 118
Hue . . . 120
Huk-dim-hung-paan . . . 245
Huk-dim-paan . . . 144
Humpback grouper . . . **63**
Hung-paan . . . 107, 118
Hyporthodus . . . *69*
Hyporthodus flavicauda . . . *69, 204*
Hyposerranus . . . *69*

I

igarashiensis, Cephalopholis . . . ***25-26, 46-47***
immaculatus, Alphestes . . . ***18, 21-23***
immunerur, Serranus . . . *34*
impetiginosus, Serranus . . . *103*
indelebilis, Bodianus . . . *35*
Indépendante . . . 292
Indio . . . **11, 283**
indistinctus, Epinephelus . . . ***168-169***
inermis, Dermatolepis . . . ***65-68***
inermis, Epinephelus . . . *66*
inermis, Serranus . . . *64, 66*
interstitialis, Mycteroperca . . . ***188, 263-264, 266-267, 272, 278-279***
interstitialis, Serranus . . . *266*
ionthas, Epinephelus . . . *106*
irrorata, Perca . . . *169*
irroratum, Percam . . . *169*
irroratus, Epinephelus . . . ***152, 169-170, 225, 227***
Ishigakihata . . . 166

Island grouper . . . **265**
Itaiara . . . *69*
itajara, Epinephelus . . . ***69-70, 171-172, 175***
itajara, Serranus . . . *69, 171*
Iyagohata . . . 212

J

Jabali . . . 135
Jack . . . 104
jacob-evertsen, Bodianus . . . *34*
Jansenii, Serranus . . . *241*
janthinopterus, Epinephelus . . . *57*
jayakari, Serranus . . . *69, 198*
Jewfish . . . **171-172**
Jiao zhï hou . . . 118, 150
Jïn hou . . . 294
Johnius guttatus . . . *256, 278*
jordani, Epinephelus . . . *268*
jordani, Mycteroperca . . . ***268-269, 273, 281***

K

Kaha laveya . . . 155
Kakehashihata . . . 223
Kalava . . . 185
Kallu kaleva . . . 197, 223
Kangan kossa . . . 43
Kasurihata . . . 249
Keapu bara . . . 294
Kêle . . . 60
Kelle . . . 51
kendalli, Cephalopholis . . . *40*
Kerapo-bebeh . . . 230
Kerapo-tutol . . . 118
Kerapu . . . 25
Kerapu bar . . . 50
Kerapu bara . . . 151, 293
Kerapu bunga . . . 35
Kerapu ekor puteh . . . 113
Kerapu minyak . . . 128
Kerapu sonoh . . . 294
Kerapu tikus . . . 64
Keretang . . . 185
Khonke . . . 51
Khonkhé . . . 60
Khoutch . . . 106
Kijihata . . . 107
Kirnja . . . 106
Kirnja ligaca . . . 135
Kito . . . 215, 247
Kitty Mitchell . . . 143
Kivongui . . . 192
Kobe . . . 137
kohleri, Epinephelus . . . *136*
Kokuhan-ara . . . 292
Kokuhanhata . . . 56
Kokuten-aohata . . . 110
Kokuten-hirehata . . . 230
Komon-hata . . . 144
Kopau . . . 170
Kotj . . . 188
Kubing . . . 17, 47
kulas, Plectropomus . . . *181*
Kunhardtii, Serranus . . . *120*
Kurohata . . . 17
Kwah-tsee paan . . . 301

L

labriformis, Epinephelus . . . ***53-54, 103, 173-174***
labriformis, Serranus . . . *69, 173*
Labroperca . . . *69*
Labrus fulvus . . . *43*
Labrus fuscus . . . *188*
Labrus Guaza . . . *188, 264, 266*
Labrus Gvaza . . . *188*
Labrus gvaza . . . *188, 264, 266*
Labrus laevis . . . *290*
Labrus leopardus . . . *47*
Labrus punctulatus . . . *304*
Labrus, guaza . . . *188*
laevis, Labrus . . . *290*
laevis, Plectropomus . . . ***290-291***
Lahoz . . . 106
Lai-paan . . . 120
Lajoojh . . . 51
lanceolatus, Epinephelus . . . ***69, 172, 174-175, 185, 210, 242***
lanceolatus, Holocentrus . . . *174*
lanceolatus, Promicrops . . . *174*
Lapu-lapung itim . . . 17
Lapu-lapung pula . . . 295
Lapu-lapung señora . . . 50
Lapu-lapung Señorita . . . 64, 304
latepictus, Serranus . . . *262*
Laterally-banded grouper . . . 177
latifasciatus, Epinephelus . . . ***69, 144, 176***
latifasciatus, Serranus . . . *176*
Leather bass . . . **11, 65**
lebretonianus, Epinephelus . . . ***177-178***
lebretonianus, Serranus . . . *177*
Leopard coral trout . . . 293
Leopard coralgrouper . . . **292**
Leopard fish . . . 294
Leopard grouper . . . **274**
Leopard hind . . . **47**
Leopard trout . . . 294
leopardinus, Paracanthistius . . . *292*
leopardinus, Plectropoma . . . *285, 292*
leopardus, Cephalopholis . . . ***26, 47***
leopardus, Holocentrus . . . *285, 292*
leopardus, Labrus . . . *47*
leopardus, Plectropomus . . . ***291-293***
leprosus, Epinephelus . . . *198-199*
leucogrammicus, Anyperodon . . . ***23***

leucogrammicus, Serranus 23
leucostigma, Serranus 239
lightfooti, Epinephelus 20
lineatum, Plectropoma 54
lineatus, Serranus 250
Lined grouper 177
lineo-ocellatus, Serranus 51
Lioperca 64
lobotoides, Epinephelus 106
Loche à bandes noires 197
Loche a bords blancs 255
Loche à taches claires 209
Loche aréolée 113
Loche bleue 137
Loche brique 227
Loche crasseuse 215
Loche géante 175
Loche morue 137
Loche pintade 128
Loche plate grise 208
Loche rayon de miel 192
Loche ronde 185
Loche rouge 151
Loche rouge du large 225
Loger 106
Long-finned grouper 221
Long-finned rock-cod 221
Longfin grouper 220
longipinna, Variola 301, 304
longispinis, Epinephelus* *178-179, 182
longispinnis, Serranus 178
Longspine grouper 178
Longtooth grouper 119
Loukouz 106
louti, Perca 301, 304
louti, Serranus 304
louti, Variola* *1, 301-305
Lu gu hou 151, 230
luctuosus, Homalogrystes 136
Lunar-tailed coral-trout 305
Lunar-tailed grouper 304
Lunar-tailed rock-cod 305
lunaris, Perca 16
lunulatus, Lutianus 161
luridus, Serranus 104, 195-196
luti, Serranus 304
Lutianus lunulatus 161
lutra, Serranus 156
Lyretail trout 304
Lyretails 11

M

Macabit 192
Maconde 36
macrocephalus, Bodianus 154
macrogenis, Cerna 275
macrospilos, Epinephelus* *116, 133, 153, 166-168, 179-180, 182, 190, 193, 221, 233, 242
macrospilos, Serranus 168, 179
maculata, Perca 150
maculatum variety *A, Plectropoma* 290, 296
maculatum variety *B, Plectropoma* 290, 292
maculatum variety *C, Plectropoma* 290, 290
maculatum variety *D, Plectropoma* 296
maculatum variety *E, Plectropoma* 297
maculatum variety *G, Plectropoma* 297
maculatum, Plectropoma 289, 298
maculatus, Bodianus 285, 293
maculatus, Cephalopholis 49
maculatus, Epinephelus* *116, 153, 167, 178-179, 181-182, 190, 193-194, 222, 233
maculatus, Holocentrus 181
maculatus, Plectropomus* *290, 292-294, 297
maculosus, Serranus 161
Madarahata 215
Madeija 160, 188
maderaspatensis, Priacanthichthys 69, 176
magniscuttis, Epinephelus* *143, 182-184, 223
Mahata 228
Mahata-modoki 208
Malabar grouper 184
malabaricus, Epinephelus* *4, 70, 131-132, 172, 184-185, 242
malabaricus, Holocentrus 184
Mama rouge 36
Mambo 293, 295
Mampagnony 305
Mangrove grouper 280
Manjel kaleva 155
Maori cod 250
Maori grouper 249
Marble grouper 158, 215
Marbled coralgrouper 297
Marbled grouper 67
Mardelucheb 35
margaritifer, Serranus 204, 206
marginalis, Epinephelus 69, 150, 186
marginalis, Serranus 186
marginatus, Bodianus 278
marginatus, Epinephelus* *106, 123, 125, 136, 160, 163, 186-189, 264, 266
marginatus, Holocentrus 150, 186
marginatus, Serranus 186, 188
marmoratus, Dermatolepis 66
marmoratus, Plectropoma 298
marmoratus, Plectropomus 297
Marquesan grouper 170
mars, Serranus 61
Masked grouper 254
Mataiti 305
Matongo 17
matterni, Epinephelus 225
Matuvi 247
mauritianus, Epinephelus 224
medurensis, Serranus 181

megachir, Epinephelus *221*
megachir, Serranus *220*
melanocelidota, Perca *220*
melanoleucus, Bodianus *290*
melanostigma, Epinephelus *116, 153, 167, 181-182, 189-191, 193, 222, 233, 242*
melanotaenia, Variola *304*
melanurus, Bodianus *112*
meleagris, Sebastes *239*
Meleches 64
Melon-seed grouper 301
Menephorus *26*
Mengardelucheb 35
Mengardeluu 35
Mennani 135
Mennani abiad 106
Mentzelii, Serranus *171*
Mére loche 185
Mero 172, 188
Mero abanderado 176
Mero acebrado 222
Mero acertijo 210
Mero aleta alta 181
Mero aleta amarilla 155
Mero aleta larga 220
Mero aleta listada 217
Mero alfombrado 179
Mero amarillo 114
Mero americano 195
Mero areolado 112
Mero azul 136
Mero azul y amarillo 154
Mero bacalao 183
Mero bandeado 152
Mero banderilla 150
Mero baya 268
Mero bigotudo 124
Mero bordiblanco 108
Mero brujo 280
Mero cabrilla 103
Mero carcelario 227
Mero celestrial 292
Mero colmenar 193
Mero colorado 161
Mero cometa 196
Mero con pintas 294
Mero coriaceo 65
Mero cuatro monturas 232
Mero de aletas amarillas 156
Mero de coral 132
Mero de coral 294
Mero de Darwin 139
Mero de Gorea 159
Mero de Haifa 162
Mero de las piedras 149
Mero de lo alto 202
Mero de lunares 198
Mero de márgenes pálidos 118
Mero de Minami-Koho 238
Mero de ocho bandas 207
Mero de pintas amarillas 243
Mero de pintas gemelas 115
Mero de pintas naranjas 130
Mero de pintas rojas 106
Mero de seis bandas 229
Mero de siete bandas 145
Mero de tres manchas 244
Mero dentón 122
Mero diente largo 119
Mero diez espinas 147
Mero disfrazado 214
Mero dorado 299
Mero elegante 24
Mero embridado 164
Mero ensillado 290
Mero errante 296
Mero escamoso 213
Mero espaldaron 189
Mero espigón 178
Mero espinudo 140
Mero gallina 238
Mero gato 111
Mero guasa 171
Mero guasa 172
Mero hawaiano 218
Mero hombrero 235
Mero jorobado 63
Mero lanceolado 174
Mero liso 68
Mero listado 200
Mero luna creciente 304
Mero lutra 241
Mero machado 203
Mero malabárico 184
Mero manchado 157
Mero Maori 249
Mero marmol 67
Mero marquesano 170
Mero medialuna 226
Mero medioluto 117
Mero mielero 165
Mero misterioso 177
Mero montado 138
Mero montura negra 167
Mero moreno 186
Mero moteado 110
Mero negro 201
Mero nevero 121
Mero nubifero 208
Mero nublado 146
Mero oleado 230
Mero ondulado 250
Mero ovalado 300
Mero pálido 143
Mero panal 191
Mero paracamo 196

Mero paranjero 254
Mero patata 248
Mero pecoso 297
Mero pintado 127
Mero pintaroja 142
Mero pintitas 158
Mero punteado 224
Mero punteado blanco 216
Mero punteado negro 234
Mero punto y linea 211
Mero rabiblanco 303
Mero reticular 246
Mero rollizo 245
Mero somalí 168
Mero sumán 239
Mero tigre 67, 217
Mero Tonga 126
Mero troncón 289
Mero vela 295
Meros 11
Merou *69*
Mérou à bandes 176
Mérou á bout rouge 224
Mérou à flocons 208
Mérou à points bleus 60
Mérou abeille 193
Mérou Africain 60
Mérou aile jaune 155
Mérou aile zébrée 217
Mérou arcane 177
Mérou aréolé 112
Mérou badèche 134
Mérou bagnard 227
Mérou bande 109
Mérou blanc 105
Mérou blanc 106
Mérou bleu 136
Mérou bord blanc 108
Mérou bord clair 118
Mérou bord rouge 254
Mérou bossu 63
Mérou bride 164
Mérou brouillard 200
Mérou cabrilla 110
Mérou camouflage 214
Mérou chat 111
Mérou comète 196
Merou coq 102
Mérou corail 132
Mérou couronné 161
Mérou cuir 65
Mérou curieux 210
Mérou d'Haifa 162
Mérou d'île 265
Mérou d'or 299
Mérou Darwin 139
Mérou de Gorée 159
Mérou demi-lune 226
Mérou demideuil 117
Mérou dix épines 147
Mérou dossard 189
Mérou du Niger 51
Mérou dungat 159
Mérou écharpe 152
Mérou élégant 24
Mérou épaulette 235
Mérou épineux 140
Mérou étoile 173
Mérou étoiles bleues 292
Mérou faraud 154
Mérou gâteau de cire 191
Mérou géant 171
Mérou géminé 115
Mérou genêt-queue 280
Mérou golfe 268
Mérou grandes écailles 183
Mérou gris 122
Mérou grivelé 142
Mérou guyot 238
Mérou haute voile 181
Mérou hawaiien 218
Mérou houleux 230
Mérou huit raies 207
Mérou jaune 114
Mérou lancéolé 174
Mérou léopard 274
Mérou lisse 68
Mérou longues ailes 220
Mérou longues dents 119
Mérou longues épines 178
Mérou loutre 241
Mérou malabare 184
Mérou maori 249
Mérou marbré 67
Mérou Marquises 170
Mérou marron 157
Mérou mélifère 165
Mérou morse 211
Mérou moustache 124
Mérou nébuleux 146
Mérou neige 205
Mérou noir 123, 186
Mérou ondulé 250
Mérou oriflamme 150
Mérou oualioua 103
Mérou ovale 300
Mérou pâle 143
Mérou passoire 158
Mérou patate 248
Mérou petites écailles 213
Mérou pintade 127
Mérou plate grise 198
Mérou pointillé 297
Mérou points blancs 216
Mérou points noirs 234
Mérou polonaise 201

Mérou poule . . . 129
Mérou quatre selles . . . 232
Mérou queue carrée . . . 289
Mérou rayé . . . 236
Mérou reseau . . . 246
Mérou rocaille . . . 149
Mérou rondelet . . . 245
Mérou rouge . . . 195
Mérou rouge . . . 188, 224
Mérou rouge tacheté . . . 106
Mérou royale . . . 275
Mérou scie-queue . . . 273
Mérou sellé . . . 290
Mérou selle noir . . . 167
Mérou sept raies . . . 145
Mérou six raies . . . 229
Mérou somali . . . 168
Mérou summan . . . 239
Mérou taches blanches . . . 121
Mérou taches jaunes . . . 243
Mérou taches oranges . . . 130
Mérou tacheté . . . 203
Mérou tapis . . . 179
Mérou tigre . . . 217
Mérou tonga . . . 126
Mérou trois taches . . . 244
Mérou troussequin . . . 138
Mérou varsovie . . . 201
Mérou voile . . . 270
Mérou zébré . . . 222
Mérou-loche cacatois . . . 295
Mérou-loche vagabonde . . . 296
Mérous . . . 11
merra, Epinephelus* . . . *116, 153, 167, 181-182, 190-192, 221-222, 233
merra, Serranus . . . *221*
Merus . . . *69*
merus, Centropristis . . . *201*
microdon, Epinephelus . . . *158, 215*
microdon, Serranus . . . *214*
microlepis, Mycteroperca* . . . *4, 263, 269-270, 278-279
microlepis, Trisotropis . . . *269*
microleptes, Uriphaeton . . . *26*
micronotatus, Serranus . . . *23*
microprion, Cephalopholis* . . . *26, 48-49
microprion, Serranus . . . *48*
Midwater grouper . . . 250
miliaris, Epinephelus* . . . *178, 193-194
miliaris, Serranus . . . *193*
miltostigma, Epinephelus . . . *35*
Minami-isohata . . . 48
Minamihata . . . 55
miniata, Cephalopholis* . . . *26, 41, 45, 49-50, 52
miniata, Perca . . . *49*
miniata variety C, *Perca* . . . *296*
miniatus, Cephalopholis . . . *45, 56*
Miro-miro . . . 64
Misty grouper . . . 200
mo-ara, Serranus . . . *119*
moara, Epinephelus . . . *120*
modestus, Epinephelus . . . *124-125*
Mokohoko . . . 305
monacanthus, Plectropoma . . . *20*
Moontail seabass . . . 304
morio, Epinephelus* . . . *104, 188, 195-196
morio, Serranus . . . *69, 195*
morrhua, Epinephelus* . . . *125, 196-198, 211-212, 222-223, 247
morrhua, Serranus . . . *69, 196, 223*
Mottled coraltrout . . . 297
Mottled grouper . . . 275
Moustache grouper . . . 124
Moustache grouper . . . 201
Moyôhata . . . 221
Mud grouper . . . 120
Mudgrouper . . . 119
multiguttatum, Plectropoma . . . *22*
multiguttatus, Alphestes* . . . *18, 22
multiguttatus, Epinephelus . . . *22*
multinotatus, Epinephelus* . . . *58, 69, 137, 155, 198-199
multinotatus, Serranus . . . *198*
Multispotted grouper . . . 158
Mushenzi . . . 35
Mutton hamlet . . . 20
Mutton hamlets . . . 11
Mycteroperca . . . *11, 18, 26, 70, 188, 256, 266-267, 271, 275-276, 278, 286, 300*
Mycteroperca acutirostris* . . . *256, 261-262, 276
Mycteroperca bonaci* . . . *262-263, 270, 278-279
Mycteroperca bonaci variety *xanthosticta* . . . *262*
Mycteroperca boulengeri . . . *256, 280*
Mycteroperca bowersi . . . *278*
Mycteroperca calliura . . . *266*
Mycteroperca cidi* . . . *188, 263-264, 267, 279
Mycteroperca falcata variety *phenax* . . . *271*
Mycteroperca fusca* . . . *135-136, 256, 261-262, 265-266, 276
Mycteroperca hopkinsi . . . *276*
Mycteroperca interstitialis* . . . *188, 263-264, 266-267, 272, 278-279
Mycteroperca jordani* . . . *268-269, 273, 281
Mycteroperca microlepis* . . . *4, 263, 269-270, 278-279
Mycteroperca olfax* . . . *270-271, 281
Mycteroperca olfax variety *ruberrima* . . . *270*
Mycteroperca pardalis . . . *256, 274*
Mycteroperca phenax* . . . *188, 263-264, 267, 271-272, 278-279
Mycteroperca prionura* . . . *269, 273, 275, 281
Mycteroperca roquensis . . . *266*
Mycteroperca rosacea* . . . *11, 256, 269, 274-275, 281
Mycteroperca rubra* . . . *135, 256, 262, 266, 275-276
Mycteroperca simonyi . . . *266*
Mycteroperca spp. . . . *255*
Mycteroperca tigris* . . . *263, 276-279
Mycteroperca venadorum . . . *268*
Mycteroperca venenosa* . . . *256, 263, 278-279
Mycteroperca xenarcha* . . . *256, 269, 273, 275, 280-281

myriaster, Serranus . . . *34*
mystacinus, Epinephelus* . . . *70, 200-201, 206, 208, 228
mystacinus, Serranus . . . *69, 200*
Mystery grouper . . . 177

N

Naam-dim-paan . . . 137
Nagil . . . 297
Namihata . . . 209
Nassau grouper . . . 236
nebulosus, Centropristes . . . *284*
nebulosus, Epinephelus . . . *147*
nebulosus, Serranus . . . *130, 147, 275*
Netfin grouper . . . 193
Ngaingo . . . 123
Niger hind . . . 51
nigri, Cephalopholis* . . . *26, 51
nigri, Petrometopon . . . *51*
nigri, Serranus . . . *51*
nigriceps, Serranus . . . *103*
nigriculus, Serranus . . . *38, 40*
nigripinnis, Cephalopholis . . . *36, 61*
nigripinnis, Epinephelus . . . *62*
nigripinnis, Serranus . . . *61*
nigritus, Epinephelus* . . . *69, 148, 163, 201-202
nigritus, Serranus . . . *69, 201*
nigrofasciatus, Serranus . . . *37*
Nijihata . . . 62
niphobles, Epinephelus* . . . *130, 203-204, 206, 219
Niphon . . . *286*
niveatus, Epinephelus* . . . *69, 103, 156, 202, 204, 206
niveatus, Serranus . . . *204*
Njombo . . . 292
Njomo . . . 298
Nodiof . . . 106
Nominokuchi . . . 245
Norteño . . . 130
Ntsehele . . . 192

O

O-aonome-ara . . . 290
Obihata . . . 150
Oblique-banded grouper . . . 222
obtusauris, Cephalopholis . . . *35*
oceanicus, Holocentrus . . . *150*
octocinctus, Serranus . . . *227*
octofasciatus, Epinephelus* . . . *146, 201, 206-208, 228
Ojiro-barahata . . . 304
okinawae, Gracila . . . *54*
olfax variety *ruberrima, Mycteroperca* . . . *270*
olfax, Mycteroperca* . . . *270-271, 281
olfax, Serranus . . . *256, 270*
oligacanthus, Plectropoma . . . *285*
oligacanthus, Plectropomus* . . . *295-296
Oligorus Goliath . . . *174*
Oligorus terrae-reginae . . . *174*
oligosticta, Cephalopholis* . . . *26, 52
Olive grouper . . . 129
Ollos . . . 62
Omon-hata . . . 113
One-blotch grouper . . . 189
ongus, Epinephelus* . . . *122, 208-209, 231, 240
Ongus, Holocentrus . . . *208*
Orange-spotted grouper . . . 130
ordinatus, Epinephelus . . . *173*
Orousin . . . 106
osbeck, Trachinus . . . *103*
Osujihata . . . 177
ouatalibi, Serranus . . . *25, 43*
Oval grouper . . . 300
oxyptera, Corvina . . . *284*

P

Paak-dim-paan . . . 227
pachycentron, Cephalopholis . . . *38, 49*
pachycentron, Serranus . . . *37*
Pacific creole-fish . . . 283
Pacific graysby . . . 53
Pacific guaseta . . . 23
Pacific mutton hamlet . . . 21
Painted coral trout . . . 304
Pak-mei-paan . . . 62
Palemargin grouper . . . 118
panamensis, Cephalopholis* . . . *26, 39, 53, 103, 174
panamensis, Epinephelus . . . *53*
panamensis, Petrometopon . . . *53*
panamensis, Serranus . . . *53*
Panther fish . . . 64
pantherinus, Holocentrus . . . *241*
Paracanthistius . . . *285*
Paracanthistius leopardinus . . . *292*
Paracanthistius suji . . . *292*
Paranthias* . . . *11, 281-283, 286, 301
Paranthias colonus* . . . *282-283, 285
Paranthias furcifer* . . . *26, 44, 281-285
Paranthias pinguis . . . *282-283*
Paranthias spp. . . . *1*
pardalis, Mycteroperca . . . *256, 274*
pardalis, Serranus . . . *220*
Parepinephelus . . . *256*
Parkinsonii, Serranus . . . *165*
Paru hoa . . . 300
Pavillion . . . 11
Pavillon espagnol . . . 252
Peacock hind . . . 34
Peisce bodi . . . 160
Perca 7-fasciata . . . *227*
Perca areolata . . . *112*
Perca fario . . . *245*
Perca fasciata . . . *134, 150*
Perca flava-purpurea . . . *69, 154*

Perca gigas 69, 162-163
Perca guttata 34, 38, 161
Perca guttatus 25, 38
Perca irrorata 169
Perca louti 301, 304
Perca lunaris 16
Perca maculata 150
Perca melanocelidota 220
Perca miniata 49
Perca miniata variety C 296
Perca punctata 43
Perca robusta 104-106
Perca rogaa 16
Perca stellio 103
Perca summana 239
Perca summana variety *fusco-guttata* 156
Perca tauvina 241
Perca tota maculis 103
Perca urodeta 61
Perca venenosa 278
Percam irroratum 169
Percam urodetam 61
Pere 305
perguttatus, Serranus 49
perplexus, Epinephelus **210-211**
peruanus, Epinephelus 203-204
pessuliferus marisrubri, Plectropomus 297
pessuliferus pessuliferus, Plectropomus 297
pessuliferus, Plectropomus **296-297**
Petit nègre 183
Petrometopon 25
Petrometopon cruentatus 38
Petrometopon nigri 51
Petrometopon panamensis 53
petrosus, Serranus 278
phaenistomus, Serranus 304
phaeostigmaeus, Serranus 174
phaeton, Serranus 26
Phaetonichthys 26
phenax, Mycteroperca **188, 263-264, 267, 271-272, 278-279**
Phrynotitan 69
pinguis, Paranthias 282-283
pixanga, Serranus 103
Plat 208
Playfayri, Epinephelus 61
Plectropoma 285
Plectropoma areolatum 289
Plectropoma chloropterum 18, 20
Plectropoma cyanostigma 292
Plectropoma fasciatus 134
Plectropoma hispanum 252
Plectropoma leopardinus 285, 292
Plectropoma lineatum 54
Plectropoma maculatum 289, 298
Plectropoma maculatum variety A 290, 296
Plectropoma maculatum variety B 290, 292
Plectropoma maculatum variety C 290
Plectropoma maculatum variety D 290, 296
Plectropoma maculatum variety E 297
Plectropoma maculatum variety G 297
Plectropoma marmoratus 298
Plectropoma monacanthus 20
Plectropoma multiguttum 22
Plectropoma oligacanthus 285
Plectropoma punctatum 285
Plectropoma susuki 227
Plectropoma variegatum 295
Plectropomus **11, 252, 285-286, 296, 298**
Plectropomus aerolatus **289-290**
Plectropomus kulas 181
Plectropomus laevis **290-291**
Plectropomus leopardus **291-293**
Plectropomus maculatus **290, 292-294, 297**
Plectropomus marmoratus 297
Plectropomus oligacanthus **295-296**
Plectropomus pessuliferus **296-297**
Plectropomus pessuliferus marisrubri 297
Plectropomus pessuliferus pessuliferus 297
Plectropomus punctatus **297-298**
Plectropomus sp. 297
Plectropomus spp. 1, 255
Plectropomus truncatus 289
Pleuroperca 285
Plump grouper 245
poecilonotus, Epinephelus **198, 211-212, 247**
poëcilonotus, Serranus 211
Polka-dot grouper 64
polleni, Cephalopholis **25-26, 42, 54-55**
polleni, Epinephelus 54
polylepis, Epinephelus **128, 159, 213-214**
polyphekadion, Epinephelus **158, 194, 214-215, 242**
polyphekadion, Serranus 214
polypodophilus, Serranus 184
polystigma, Epinephelus **216-217**
polystigma, Serranus 216
Pomacentrus burdi 49
popino, Cephalopholis 102
posteli, Epinephelus **217-218**
Potato bass 249
Potato cod 249
Potato grouper 248
powelli, Saloptia **298-299**
praeopercularis, Epinephelus 212
praeopercularis, Serranus 143
Preie 305
Priacanthichthys 69
Priacanthichthys maderaspatensis 69, 176
Princess rockfish 279
prionura, Mycteroperca **269, 273, 275, 281**
Promicrops 69-70, 172, 175
Promicrops ditobo 171
Promicrops esonue 171
Promicrops lanceolatus 174
Prospinus 18

pseudomorrhua, Epinephelus 182, 184
Pseudoserranus 301
Pugapo 48, 158
punctata, Perca 43
punctatissimus, Serranus 136
punctatum, Plectropoma 285
punctatus, Dermatolepis 64-65
punctatus, Holocentrus 65, 161
punctatus, Plectropomus 297-298
punctulatus, Labrus 304
Punni-calawah 185
Purple rockcod 137
purpurescens, Halichoeres 25
purpureus, Cephalopholis 57
Puzzling grouper 210

Q

quernus, Epinephelus 218-219
quinquefasciatus, Serranus 171
quoyanus, Epinephelus 116, 153, 167, 179-182, 190, 193, 220-221, 233
quoyanus, Serranus 220

R

radiatus, Epinephelus 197-198, 212, 222-223, 247
radiatus, Serranus 222
rahanus, Epinephelus 216
Raja laveya 223
rankini, Epinephelus 198
Rari 56
raymondi, Epinephelus 225
Red grouper 107
Red grouper 195
Red hind 161
Red rockfish 279
Red-edged grouper 254
Red-speckled rock-cod 250
Red-spotted rockcod 48
Red-tipped grouper 224
Redbanded grouper 150
Redmouth grouper 16
Redmouth rockcod 17
reevesii, Serranus 127
remotus, Serranus 195
repandus, Serranus 276
Rero 62
Reticulate grouper 246
reticulatus, Serranus 208
reticulatus, Trisotropis 276
retouti, Epinephelus 152, 224-225, 227
Retouti, Epinephelus 224
rhyncholepis, Serranus 225
Rikotté 106
Rivulated mutton hamlet 22
rivulatus, Epinephelus 141, 152, 225-227, 236
rivulatus, Serranus 225, 276
robusta, Perca 104-106
Rock cod 104
Rock grouper 149
Rock hind 103
Rockfish 263
rogaa, Aethaloperca 16
rogaa, Cephalopholis 16
rogaa, Perca 16
Roi 35
Rooibek-kabeljou 17
Rooster hind 102
roquensis, Mycteroperca 266
rosacea, Mycteroperca 11, 256, 269, 274-275, 281
rosaceus, Epinephelus 274
roseus, Serranus 304
rosmarus, Holocentrus 150
Rouge du large 225
Rouge sale 227
Roughcheek hind 52
Rour 123
Roving coralgrouper 296
ruber, Epinephelus 275-276
ruber, Gymnocephalus 43
rubra, Epinephelus 224
rubra, Mycteroperca 135, 256, 262, 266, 275-276
rufus, Serranus 35
Rumekei 50
rupestris, Serranus 278
Rusty hind 33
Ryfana 58

S

Saddleback grouper 292
Saddled rockcod 139
Saddletail grouper 138
Sailfin grouper 270
salmoïdes, Holocentrus 184
salmonoides, Serranus 184
salonotus, Epinephelus 232, 242
Saloptia 11, 252, 286, 298, 300
Saloptia powelli 298-299
Sama 265
Sampamale 305
Sandovika 160
Sarasa-hata 64
Saumonée grosse race 292
Saumonée hirondelle 305
Saumonée léopard 292
Saumonée-léopard 293
Saw-law-paan 177
Sawtail grouper 273
Scamp 271
Schistorus 69
scholanderi, Alphestes 204, 205
Sciaena formosa 42

Seamount grouper 238
Sebae, Serranus 181
Sebastes meleagris 239
Sek-dang 150
sellicauda, Epinephelus 173
semi-punctatus, Serranus 184
septemfasciatus, Epinephelus **3-4, 125, 146, 201, 206-208, 227-228**
Serranichthys 63
Serranus 26, 284
Serranus abdominalis 174
Serranus acutirostris 256, 261, 266
Serranus aeneus 104
Serranus aka-ara 106
Serranus alatus 220
Serranus alboguttatus 120
Serranus alexandrinus 135, 150
Serranus altivelioides 132
Serranus altivelis 63
Serranus amblycephalus 109
Serranus amboinensis 250
Serranus analis 35
Serranus angularis 112
Serranus angustifrons 195
Serranus apiarius 38
Serranus Ara 244
Serranus arara 161, 262
Serranus areolatus japonicus 127
Serranus armatus 275
Serranus aspersus 186
Serranus assabensis 127
Serranus aurantius 35
Serranus australis 216
Serranus awo-ara 114
Serranus bataviensis 208
Serranus Bleekeri 117-118
Serranus boelang 37-38
Serranus bonaci 262
Serranus bontoides 118
Serranus bontoo 152
Serranus borbonicus 154
Serranus brunneus 262
Serranus camelopardalis 276
Serranus caninus 122
Serranus capreolus 103
Serranus carauna 43
Serranus cardinalis 278
Serranus carniatus 220
Serranus castelnaui 284
Serranus catus 40, 161
Serranus celebicus 112
Serranus celebicus variety *multipunctatus* 127
Serranus cernioides 186
Serranus cernipedis 304
Serranus Chabaudi 124
Serranus chlorocephalus 126
Serranus chlorostigma 127
Serranus chrysotaenia 134
Serranus colonus 283
Serranus conspersus 204
Serranus corallicola 132
Serranus Coromandelicus 117-118
Serranus coronatus 38
Serranus courtadei 110
Serranus crapao 184
Serranus creolus 281, 284
Serranus cruentus 150
Serranus cyanostigma 40
Serranus cyanostigmatoides 49
Serranus cyclopomatus 262
Serranus cylindricus 179
Serranus Dämelii 138
Serranus decimalis 262
Serranus dermochirus 120
Serranus dermopterus 300
Serranus dichropterus 208
Serranus diktiophorus 193
Serranus dimidiatus 266
Serranus dispar 214
Serranus dispar variety A 248
Serranus dispar variety B 214
Serranus dubius 26
Serranus emarginatus 265-266
Serranus epistictus 143
Serranus erythraeus 61
Serranus erythrogaster 195
Serranus estuarius 184
Serranus falcatus 266
Serranus fasciatomaculosus 148
Serranus faveatus 152
Serranus felinus 276
Serranus fimbriatus 186
Serranus flavimarginatus 304
Serranus flavoguttatus 120
Serranus furcifer 281, 284
Serranus fuscus 265-266
Serranus Gaimardi 193
Serranus galeus 171
Serranus Geoffroyi 127
Serranus geographicus 174
Serranus geometricus 150
Serranus gibbosus 68
Serranus gigas 188-189
Serranus Gilberti 220
Serranus glaucus 112
Serranus Goldiei 241
Serranus Goldmanni 214
Serranus goreensis 135, 159
Serranus grammicus 176
Serranus guasa 69, 171
Serranus guaza 189
Serranus guttatus 25
Serranus guttulatus 249
Serranus gymnopareius 236
Serranus hemistiktos 44

Serranus Hoedtii . . . 136
Serranus Hoevenii . . . 120
Serranus homfrayi . . . 47
Serranus horridus . . . 156
Serranus howlandi . . . 167-168
Serranus immunerur . . . 34
Serranus impetiginosus . . . 103
Serranus inermis . . . 64, 66
Serranus interstitialis . . . 266
Serranus itajara . . . 69, 171
Serranus Jansenii . . . 241
Serranus jayakari . . . 69, 198
Serranus Kunhardtii . . . 120
Serranus labriformis . . . 69, 173
Serranus latepictus . . . 262
Serranus latifasciatus . . . 176
Serranus lebretonianus . . . 177
Serranus leucogrammicus . . . 23
Serranus leucostigma . . . 239
Serranus lineatus . . . 250
Serranus lineo-ocellatus . . . 51
Serranus longispinnis . . . 178
Serranus louti . . . 304
Serranus luridus . . . 104, 195-196
Serranus luti . . . 304
Serranus lutra . . . 156
Serranus macrospilos . . . 168, 179
Serranus maculosus . . . 161
Serranus margaritifer . . . 204, 206
Serranus marginalis . . . 186
Serranus marginatus . . . 186, 188
Serranus mars . . . 61
Serranus medurensis . . . 181
Serranus megachir . . . 220
Serranus Mentzelii . . . 171
Serranus merra . . . 221
Serranus microdon . . . 214
Serranus micronotatus . . . 23
Serranus microprion . . . 48
Serranus miliaris . . . 193
Serranus mo-ara . . . 119
Serranus morio . . . 69, 195
Serranus morrhua . . . 69, 196, 223
Serranus multinotatus . . . 198
Serranus myriaster . . . 34
Serranus mystacinus . . . 69, 200
Serranus nebulosus . . . 130, 147, 275
Serranus nigri . . . 51
Serranus nigriceps . . . 103
Serranus nigriculus . . . 38, 40
Serranus nigripinnis . . . 61
Serranus nigritus . . . 69, 201
Serranus nigrofasciatus . . . 37
Serranus niveatus . . . 204
Serranus octocinctus . . . 227
Serranus olfax . . . 256, 270
Serranus ouatalibi . . . 25, 43
Serranus pachycentron . . . 37
Serranus panamensis . . . 53
Serranus pardalis . . . 220
Serranus, Parkinsonii . . . 165
Serranus perguttatus . . . 49
Serranus petrosus . . . 278
Serranus phaenistomus . . . 304
Serranus phaeostigmaeus . . . 174
Serranus phaeton . . . 26
Serranus pixanga . . . 103
Serranus poëcilonotus . . . 211
Serranus polyphekadion . . . 214
Serranus polypodophilus . . . 184
Serranus polystigma . . . 216
Serranus praeopercularis . . . 143
Serranus punctatissimus . . . 136
Serranus quinquefasciatus . . . 171
Serranus quoyanus . . . 220
Serranus radiatus . . . 222
Serranus reevesii . . . 127
Serranus remotus . . . 195
Serranus repandus . . . 276
Serranus reticulatus . . . 208
Serranus rhyncholepis . . . 225
Serranus rivulatus . . . 225, 276
Serranus roseus . . . 304
Serranus rufus . . . 35
Serranus rupestris . . . 278
Serranus salmonoides . . . 184
Serranus Sebae . . . 181
Serranus semi-punctatus . . . 184
Serranus sexfasciatus . . . 140, 229
Serranus sexmaculatus . . . 55
Serranus shihpan . . . 106
Serranus simonyi . . . 265-266
Serranus socialis . . . 230
Serranus sonnerati . . . 57
Serranus spiloparaeus . . . 58
Serranus spilurus . . . 47
Serranus spiniger . . . 169
Serranus Stathouderi . . . 161
Serranus stellans . . . 165
Serranus stigmapomus . . . 37
Serranus stoliczkae . . . 235
Serranus striolatus . . . 68
Serranus subfasciatus . . . 150
Serranus suillus . . . 130
Serranus taeniocheirus . . . 156
Serranus taeniops . . . 60
Serranus tauvina . . . 127
Serranus tigris . . . 276
Serranus tinca . . . 275
Serranus trimaculatus . . . 244
Serranus Tsirimen-ara . . . 150
Serranus tumilabrus . . . 208
Serranus undulatostriatus . . . 249
Serranus undulosus . . . 261

Serranus unicolor 57
Serranus ura 244
Serranus urophthalmus 23
Serranus variegatus 106
Serranus variolosus 117, 150
Serranus varius 103
Serranus viridipinnis 225
Serranus Waandersii 112, 117
Serranus zanana 55-56
Serranus zananella 57
Serrihastaperca 69
Serrihastaperca exsul 69, 147-148
Sevenbar grouper 145
***sexfasciatus, Epinephelus* 141, 229-230**
sexfasciatus, Serranus 140, 229
***sexmaculata, Cephalopholis* 26, 45, 55-56**
sexmaculatus, Serranus 55
Seyu 251
Shenbandro 35
Shi-hou 38
shihpan, Serranus 106
Shima-hata 47
Shimofurihata 227
Shirobuchihata 182
Shnenu 45
sicana, Cerna 162-163
sicana, Epinephelus 163
Siggapu-cullawah 58
simonyi, Mycteroperca 266
simonyi, Serranus 265-266
Six-banded grouper 235
Six-blotch rockcod 56
Sixbar grouper 229
Sixblotch hind 55
slacksmithi, Epinephelus 208
Slender grouper 24
Small-toothed rockcod 215
Smallscaled grouper 213
Smooth grouper 68
Snakeskin seabass 247
Snowy grouper 204-205
Snubnose grouper 179
***socialis, Epinephelus* 230-231**
socialis, Serranus 230
Somali grouper 168
Somman 214
***sonnerati, Cephalopholis* 25-26, 36, 57-58**
sonnerati, Serranus 57
sp.- A1, *Epinephelus* 134
sp.- A2, *Epinephelus* 134
sp.- B1, *Epinephelus* 123
Spanish flag 11, 252
Sparus chrysomelas 236
Sparus cruentatus 38
Speckled blue grouper 136
Speckled grouper 183
Speckled hind 142
Specklefin rockcod 209
Sphyrida 106
***spiloparaea, Cephalopholis* 26, 36, 58-59**
spiloparaeus, Serranus 58
***spilotoceps, Epinephelus* 116, 133, 153, 166-167, 181-182, 190, 193, 222, 232-233, 242**
spilotus, Epinephelus 167
spilurus, Serranus 47
spiniger, Serranus 169
Spinycheek grouper 140
spiramen, Epinephelus 225
Spotted black grouper 139
Spotted coralgrouper 294
Spotted coraltrout 294
Spotted grouper 110-111
Spotted rockcod 112
Squaretail coral trout 290
Squaretail coralgrouper 289
Squaretail coraltrout 289
Squaretail rockcod 113
Star-studded grouper 203
Starry grouper 173
Starspotted grouper 165
Stathouderi, Serranus 161
stellans, Serranus 165
stellatus, Bodianus 38
stellio, Perca 103
Stereolepoides 69
Stereolepoides thompsoni 69, 174, 210
***stictus, Epinephelus* 69, 141, 234-235**
stigmapomus, Serranus 37
stigmogrammacus, Epinephelus 143
Stira 135
***stoliczkae, Epinephelus* 235-236**
stoliczkae, Serranus 235
stomias, Trisotropis 269
Strawberry grouper 162
Strawberry hind 59
Streakyspot grouper 178
Streakyspot rockcod 179
striatus, Anthias 236
***striatus, Epinephelus* 1, 4, 43, 236-238**
***striolata, Dermatolepis* 65, 68**
striolatus, Serranus 68
Striped grouper 176
Striped-fin grouper 217
subfasciatus, Serranus 150
***suborbitalis, Epinephelus* 238-239**
suillus, Epinephelus 132, 185
suillus, Serranus 130
suitonis, Epinephelus 136
suji, Paracanthistius 292
Suji-ara 293
Sumitsukihata 190
Summan 35
Summan grouper 239
summana hostiaretis, Epinephelus 208
summana variety *fusco-guttata, Perca* 156

summana, Epinephelus* . *121-122, 125, 209, 239-240
summana, Perca *239*
Suno 62, 293
Sunolawian 304
Sunong pula 295
Sunong-kabang 292
Surge grouper 230
susuki, Plectropoma *227*
swanius, Cephalopholis *46*

T

Taaiao 166
taeniocheirus, Serranus *156*
taeniops, Cephalopholis* *26, 60
taeniops, Serranus *60*
Taguma 137
Tamakai 175
Tammonhata 192
Tangkaan 151
Tarao a'au 166
Tarao maraurau 192
Tashanisi 135
Tatesuji-hata 255
tauvina, Epinephelus* *1, 131-132, 180, 185-186, 190-191, 241-242
tauvina, Perca *241*
tauvina, Serranus *127*
Teda 151
Teeiao 166
Tenspine grouper 147
terrae-reginae, Oligorus *174*
Tewa 17, 25
Tewa ndudu 192
Thinspine grouper 255
thompsoni, Epinephelus *210*
thompsoni, Stereolepoides *69, 174, 210*
Thornycheek grouper 140
Threespot grouper 244
Tiger grouper 158, 217
Tiger grouper 277
Tiger trout 292
tigris, Mycteroperca* *263, 276-279
tigris, Serranus *276*
timorensis, Epinephelus* *243-244
tinca, Serranus *275*
Tiof 106
Tire bourre 304
Tobihata 301
Tofia 162
Tomato hind 57
Tonga grouper 126
Tonu 292-293
tota maculis, Perca *103*
Townsendi, Epinephelus *146*
Trachinus adscensionis *103*
Trachinus osbeck *103*
trimaculatus, Epinephelus* *115, 244-245
trimaculatus, Serranus *244*
Triso* *11, 26, 300-301
Triso dermopterus* *300-301
Trisotropis *256, 300*
Trisotropis aguaji *262*
Trisotropis chlorostomus *266*
Trisotropis microlepis *269*
Trisotropis reticulatus *276*
Trisotropis stomias *269*
trophis, Epinephelus* *155, 245-246
truncatus, Epinephelus *224, 300*
truncatus, Plectropomus *289*
Tsirimen-ara, Serranus *150*
Tsuchihozeri 137
tuamotuensis, Epinephelus* *198, 212, 246-247
Tukorokoro 56
tukula, Epinephelus* *248-249
tumilabrus, Serranus *208*
Twinspot grouper 115

U

undulatostriatus, Epinephelus* *249-250
undulatostriatus, Serranus *249*
undulosus, Bodianus *250, 261*
undulosus, Epinephelus* *1, 69, 250-251
undulosus, Serranus *261*
unicolor, Serranus *57*
ura, Serranus *244*
Uriphaeton *26*
Uriphaeton microleptes *26*
urodelops, Epinephelus *47*
urodeta, Cephalopholis* *26, 57, 61-62
urodeta, Perca *61*
urodetam, Percam *61*
urophthalmus, Serranus *23*

V

Varech 20
Varech pacifique 21
Varech veiné 22
Vareches 11
Varianchamman 43
variegatum, Plectropoma *295*
variegatus, Serranus *106*
Variola* *11, 301-302
Variola albimarginata* *302-305
Variola longipinna *301, 304*
Variola louti* *1, 301-305
Variola melanotaenia *304*
variolosus, Serranus *117, 150*
varius, Serranus *103*
venadorum, Mycteroperca *268*
venenosa, Mycteroperca* *256, 263, 278-279
venenosa, Perca *278*
Venezuelan grouper 264

Vermiculate coral trout 295
Vermilion hind 52
Vermilion seabass 49-50
Verri-cullawah 43
Veve 192
Vieille abeille 193
Vieille babonne 298
Vieille crabbe 158
Vieille cuisinier 122
Vieille faraud 155
Vieille machatta 158
Vieille maconde 128
Vieille mulâtresse 304
Vieille plate 155
Vieille plate grise 208
Vieille rouge 151, 225
Vieille Saint-Sillac 183
Vieille tukula 249
Vieille Voleuse 192
Vielle aile noire 61
Vielle anana 50
Vielle ananas 57
Vielle arlequin 54
Vielle cecille 35
Vielle chocolat 37
Vielle cuisnier 35
Vielle d'Arabie 44
Vielle de corail 49
Vielle de la Mer Rouge 52
Vielle dorée 35
Vielle étoilée 49
Vielle étoiles bleues 40
Vielle fraise 59
Vielle la pruda 34
Vielle léopard 47
Vielle lignes bleues 42
Vielle loutre 242
Vielle maconde 113
Vielle plate 113
Vielle plate grise 198
Vielle roga 16
Vielle rouge 50
Vielle rouillé 33
Vielle Saint-Silac 294
Vielle six taches 55
Vielle tache de rousseur 48
Vielle voyant 46
Vielles 11
virgatus, Cephalopholis 54
viridipinnis, Serranus 225
Viuda 67
Vivano 305
Vivero 69

W

Waandersii, Serranus 112, 117
Wakar 106, 135
Warsaw grouper 201
Wavy-lined grouper 250
White grouper 105
White-blotched grouper 198
White-blotched rockcod 199
White-dotted grouper 216
White-dotted grouper 227
White-edged grouper 108
White-edged lyretail 303
White-margined grouper 255
White-specked grouper 165
White-streaked grouper 208
Whitespotted grouper 121
Wire-netting cod 192
Wong-dang 115
Wong-paan 115
Woo-sze 38
woorei, Altiserranus 300

X

xanthoptera, Cephalopholis 40-41
xenarcha, Mycteroperca 256, 269, 273, 275, 280-281
Xissumba 58
Xystroperca 256

Y

Yaitohata 185
Yamabukihata 300
Yau-paan 197, 223
Yellow grouper 114
Yellow-edged lyretail 304
Yellow-spotted rockcod 113
Yellowbelly rockcod 188
Yellowedge grouper 155
Yellowfin grouper 278
Yellowfin hind 44
Yellowmouth grouper 266
Yellowspotted grouper 243
Yuen-may-tsee-mah-paan 128
Yukatahata 50

Z

zanana, Serranus 55-56
zananella, Serranus 57
zanclus, Dermatolepis 66
zapyrus, Epinephelus 150
zaslavskii, Epinephelus 134-136

7. COLOUR PLATES

PLATE I

A. *Aethaloperca rogaa*, 295 mm SL
B. *Alphestes afer*, 186 mm SL
C. *Anyperodon leucogrammicus*, 242 mm SL
D. *Cephalopholis aitha*, 141 mm SL
E. *Cephalopholis argus*, 211 mm SL
F. *Cephalopholis aurantia*, 224 mm SL

PLATE II

A. *Cephalopholis boenak*, 129 mm SL
B. *Cephalopholis cruentata*, 236 mm SL
C. *Cephalopholis cyanostigma*, 199 mm SL
D. *Cephalopholis cyanostigma*, 98 mm SL
E. *Cephalopholis formosa*, 135 mm SL
F. *Cephalopholis fulva*

PLATE III

A. *Cephalopholis fulva*
B. *Cephalopholis fulva*
C. *Cephalopholis hemistiktos*, 120 mm SL
D. *Cephalopholis igarashiensis*, 148 mm SL
E. *Cephalopholis leopardus*, 109 mm SL
F. *Cephalopholis microprion*, 90 mm SL

PLATE IV

A. *Cephalopholis miniata*, 159 mm SL
B. *Cephalopholis miniata*, 98,5 mm SL
C. *Cephalopholis oligosticta*, 172 mm SL
D. *Cephalopholis panamensis*
E. *Cephalopholis polleni*, 94 mm SL
F. *Cephalopholis sexmaculata*, 250 mm SL

PLATE V

A. *Cephalopholis sonnerati*, 337 mm SL
B. *Cephalopholis sonnerati*, 211 mm SL
C. *Cephalopholis sonnerati*, 158 mm SL
D. *Cephalopholis spiloparaea*, 125 mm SL
E. *Cephalopholis taeniops*
F. *Cephalopholis urodeta*, 151 mm SL

PLATE VI

A. *Cephalopholis urodeta*, 136 mm SL
B. *Cromileptes altivelis*, 93 mm SL
C. *Dermatolepis dermatolepis*
D. *Dermatolepis dermatolepis*
E. *Dermatolepis inermis*, ~500 mm TL
F. *Dermatolepis striolata*, ~500 mm SL

PLATE VII

A. *Epinephelus acanthistius*
B. *Epinephelus adscensionis*, 275 mm SL
C. *Epinephelus aeneus*, 450 mm SL
D. *Epinephelus akaara*, 232 mm SL
E. *Epinephelus albomarginatus*, 100 mm SL
F. *Epinephelus amblycephalus*, 314 mm SL

PLATE VIII

A. *Epinephelus analogus*, ~760 mm TL
B. *Epinephelus andersoni*, 372 mm SL
C. *Epinephelus areolatus*, 253 mm SL
D. *Epinephelus awoara*, 301 mm SL
E. *Epinephelus awoara*, 202 mm SL
F. *Epinephelus bilobatus*, ~230 mm TL

PLATE IX

A. *Epinephelus bleekeri*, 326 mm SL
B. *Epinephelus bleekeri*, 193 mm SL
C. *Epinephelus bontoides*, 130 mm SL
D. *Epinephelus bruneus*, 437 mm SL
E. *Epinephelus bruneus*, 400 mm SL
F. *Epinephelus caeruleopunctatus*, 330 mm SL

PLATE X

A. *Epinephelus caeruleopunctatus*
B. *Epinephelus chabaudi*, 330 mm SL
C. *Epinephelus chlorostigma*, 327 mm SL
D. *Epinephelus coioides*, 323 mm SL
E. *Epinephelus corallicola*, 194 mm SL
F. *Epinephelus corallicola*, 60 mm SL

PLATE XI

A. *Epinephelus costae*, 400 mm SL
B. *Epinephelus costae*
C. *Epinephelus cyanopodus*, 319 mm SL
D. *Epinephelus cyanopodus*, 180 mm SL
E. *Epinephelus daemelii*, 230 mm SL
F. *Epinephelus darwinensis*, 535 mm SL

PLATE XII

A. *Epinephelus diacanthus*, 327 mm SL
B. *Epinephelus drummondhayi*, ~250 mm SL
C. *Epinephelus drummondhayi*, 100 mm SL
D. *Epinephelus epistictus*, 503 mm SL
E. *Epinephelus epistictus*, 371 mm SL
F. *Epinephelus ergastularius*

PLATE XIII

A. *Epinephelus erythrurus*, 219 mm SL
B. *Epinephelus fasciatomaculosus*, 205 mm SL
C. *Epinephelus fasciatus*, 218 mm SL
D. *Epinephelus fasciatus*, 207 mm SL
E. *Epinephelus fasciatus*, 151 mm SL
F. *Epinephelus faveatus*, 209 mm SL

PLATE XIV

A. *Epinephelus flavocaeruleus*, 660 mm SL
B. *Epinephelus flavocaeruleus*, 410 mm SL
C. *Epinephelus flavolimbatus*
D. *Epinephelus flavolimbatus*, 30 mm SL
E. *Epinephelus fuscoguttatus*, 120 mm SL
F. *Epinephelus gabriellae*, 224 mm SL

PLATE XV

A. *Epinephelus goreensis*
B. *Epinephelus guttatus*, 250 mm SL
C. *Epinephelus haifensis*, 326 mm SL
D. *Epinephelus heniochus*, 200 mm SL
E. *Epinephelus hexagonatus*, 160 mm SL
F. *Epinephelus howlandi*, 268 mm SL

PLATE XVI

A. *Epinephelus irroratus*, 277 mm SL
B. *Epinephelus itajara*, 520 mm SL
C. *Epinephelus labriformis*, ~130 mm TL
D. *Epinephelus lanceolatus*, ~1700 mm SL
E. *Epinephelus latifasciatus*, 273 mm SL
F. *Epinephelus latifasciatus*, 168 mm SL

PLATE XVII

A. *Epinephelus longispinis*, 298 mm SL
B. *Epinephelus macrospilos*, 290 mm SL
C. *Epinephelus macrospilos*, 186 mm SL
D. *Epinephelus macrospilos*, 73 mm SL
E. *Epinephelus maculatus*, 251 mm SL
F. *Epinephelus magniscuttis*, 320 mm SL

PLATE XVIII

A. *Epinephelus malabaricus*, 316 mm SL
B. *Epinephelus marginatus*, ~290 mm SL
C. *Epinephelus melanostigma*, 107 mm SL
D. *Epinephelus merra*, 172 mm SL
E. *Epinephelus merra*, 63,3 mm SL
F. *Epinephelus miliaris*, 430 mm SL

PLATE XIX

A. *Epinephelus morio*, ~230 mm SL
B. *Epinephelus morrhua*, 512 mm SL
C. *Epinephelus multinotatus*, 519 mm SL
D. *Epinephelus multinotatus*, 340 mm SL
E. *Epinephelus mystacinus*, ~60 mm TL
F. *Epinephelus nigritus*, 600 mm SL

PLATE XX

A. *Epinephelus niveatus*, ~60 mm TL
B. *Epinephelus octofasciatus*, 228 mm SL
C. *Epinephelus ongus*, 219 mm SL
D. *Epinephelus poecilonotus*, 520 mm SL
E. *Epinephelus polylepis*, 440 mm SL
F. *Epinephelus polyphekadion*, 408 mm SL

PLATE XXI

A. *Epinephelus polystigma*, 245 mm TL
B. *Epinephelus posteli*, 610 mm SL
C. *Epinephelus quernus*, ~550 mm TL
D. *Epinephelus quoyanus*, 245 mm SL
E. *Epinephelus radiatus*, 282 mm SL
F. *Epinephelus retouti*, 286 mm SL

PLATE XXII

A. *Epinephelus rivulatus*, 213 mm SL
B. *Epinephelus septemfasciatus*, 231 mm SL
C. *Epinephelus sexfasciatus*, 208 mm SL
D. *Epinephelus socialis*, ~230 mm TL
E. *Epinephelus spilotoceps*, 189 mm SL
F. *Epinephelus stictus*, 328 mm SL

PLATE XXIII

A. *Epinephelus stoliczkae*, 198 mm SL
B. *Epinephelus striatus*
C. *Epinephelus summana*, 334 mm SL
D. *Epinephelus tauvina*, 407 mm SL
E. *Epinephelus tauvina*, 191 mm SL
F. *Epinephelus tauvina*, 113 mm SL

PLATE XXIV

A. *Epinephelus timorensis*, 226 mm SL
B. *Epinephelus trimaculatus*, 269 mm SL
C. *Epinephelus tuamotuensis*, 398 mm SL
D. *Epinephelus tukula*, 320 mm SL
E. *Epinephelus undulatostriatus*, 262 mm SL
F. *Epinephelus undulosus*, 600 mm SL

PLATE XXV

A. *Epinephelus undulosus*, 159 mm SL
B. *Gonioplectrus hispanus*, 105 mm SL
C. *Gracila albomarginata*, 231 mm SL
D. *Gracila albomarginata*, 125 mm SL
E. *Mycteroperca acutirostris*, 175 mm SL
F. *Mycteroperca bonaci*, 75 mm SL

PLATE XXVI

A. *Mycteroperca fusca*, 400 mm SL
B. *Mycteroperca fusca*, 340 mm SL
C. *Mycteroperca fusca*, 120 mm SL
D. *Mycteroperca interstitialis*, 400 mm SL
E. *Mycteroperca interstitialis*, 322 mm SL
F. *Mycteroperca interstitialis*, 137 mm SL

PLATE XXVII

A. *Mycteroperca microlepis*, 951 mm SL
B. *Mycteroperca microlepis*, 235 mm SL
C. *Mycteroperca microlepis*, 40 mm SL
D. *Mycteroperca phenax*, 500 mm SL
E. *Mycteroperca phenax*, 240 mm SL
F. *Mycteroperca prionura*, 500 mm SL

PLATE XXVIII

A. *Mycteroperca rosacea*, 500 mm SL
B. *Mycteroperca rubra*
C. *Mycteroperca tigris*, 90 mm SL
D. *Mycteroperca tigris*, 90 mm TL
E. *Mycteroperca venenosa*, 235 mm SL
F. *Mycteroperca venenosa*, 176 mm SL

PLATE XXIX

A. *Paranthias furcifer*
B. *Plectropomus areolatus*, 374 mm SL
C. *Plectropomus laevis*, 597 mm SL
D. *Plectropomus laevis*, 475 mm SL
E. *Plectropomus leopardus*, 500 mm SL
F. *Plectropomus maculatus*

PLATE XXX

A. *Plectropomus oligacanthus*, 241 mm SL
B. *Plectropomus pessuliferus*, 480 mm SL
C. *Plectropomus pessuliferus*, 392 mm SL
D. *Plectropomus punctatus*, 446 mm SL
E. *Plectropomus punctatus*, 900 mm TL
F. *Plectropomus punctatus*, 900 mm TL

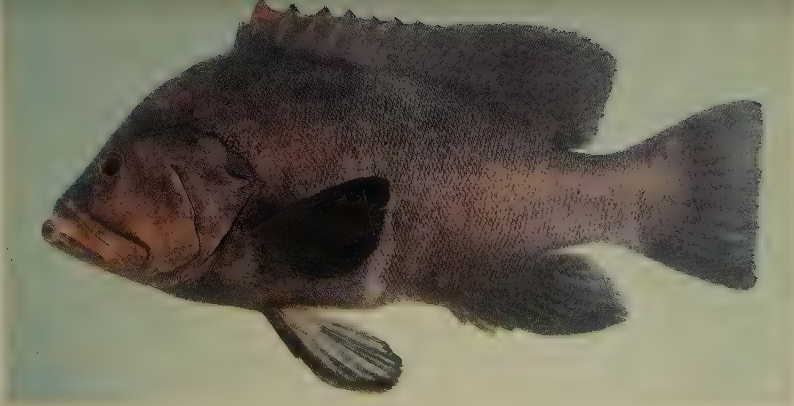
PLATE XXXI

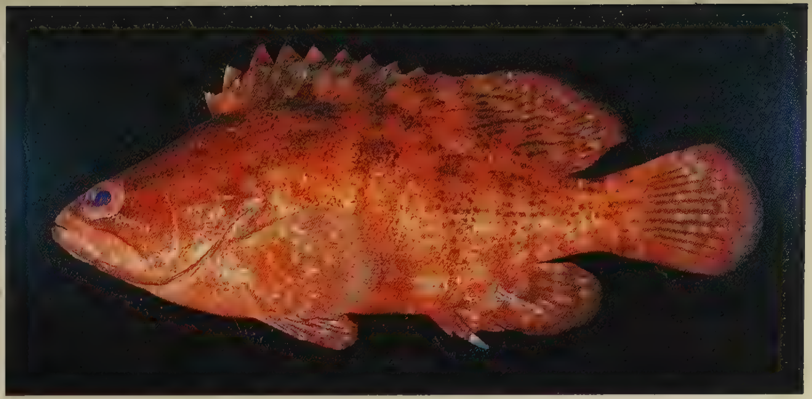
A. *Plectropomus punctatus*, ~200 mm TL
B. *Saloptia powelli*, 385 mm SL
C. *Triso dermopterus*, 245 mm SL
D. *Variola albimarginata*, 212 mm SL
E. *Variola louti*, 267 mm SL
F. *Variola louti*

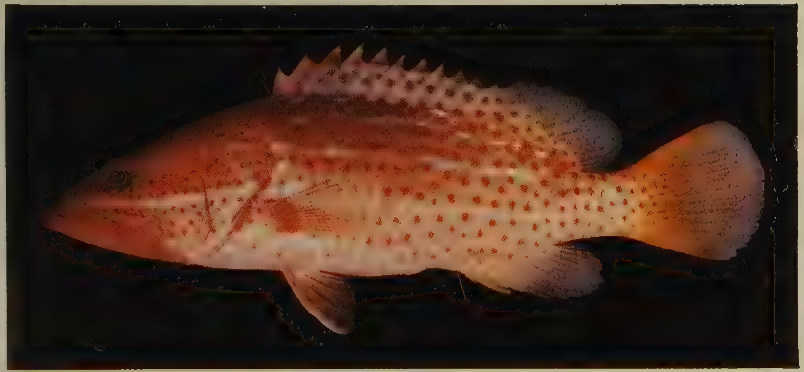
COLOUR FIGURES

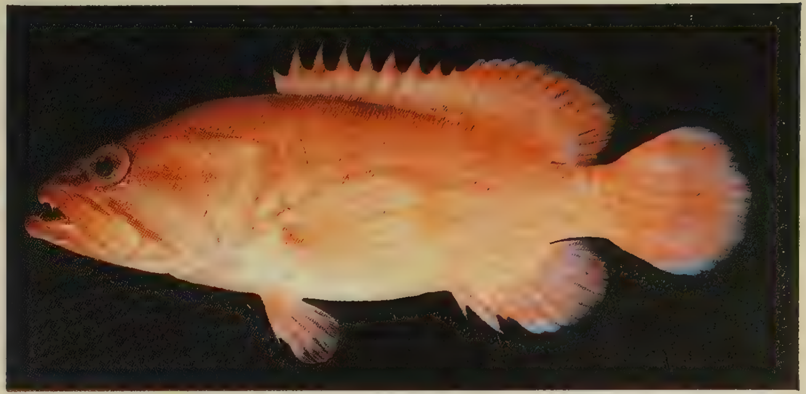
COLOUR PLATES

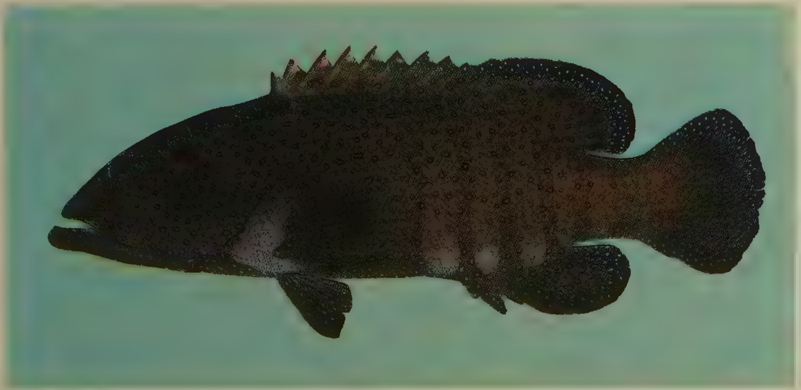
PLATE I


a) *Aethaloperca rogaa*, 295 mm SL, Bahrain, Persian Gulf
(J.E. Randall)


b) *Alphestes afer*, 186 mm SL, St. John, Virgin Islands
(J.E. Randall)


c) *Anyperodon leucogrammicus*, 242 mm SL, Palau Islands
(J.E. Randall)


d) *Cephalopholis aitha*, 141 mm SL, Madang, Papua New Guinea
(J.E. Randall)


e) *Cephalopholis argus*, 211 mm SL, Sudan, Red Sea
(J.E. Randall)

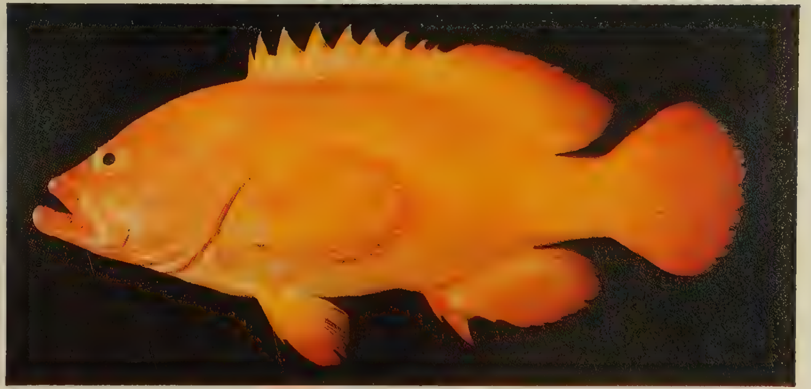
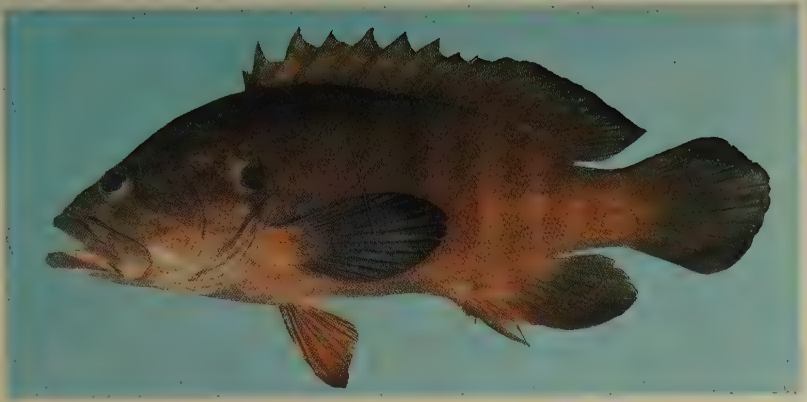
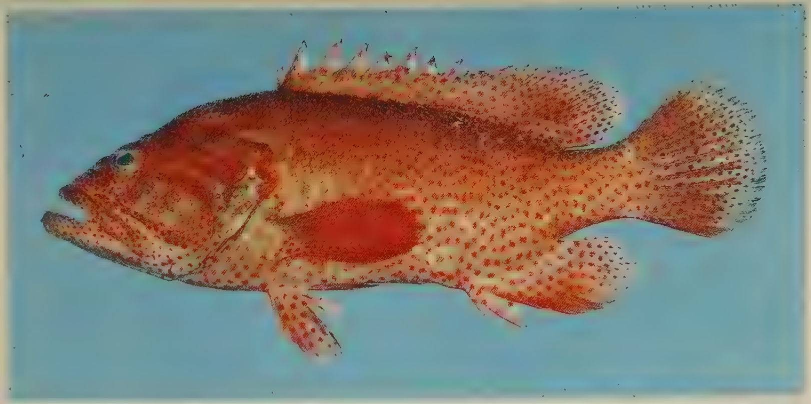

f) *Cephalopholis aurantia*, 224 mm SL, Mauritius
(J.E. Randall)

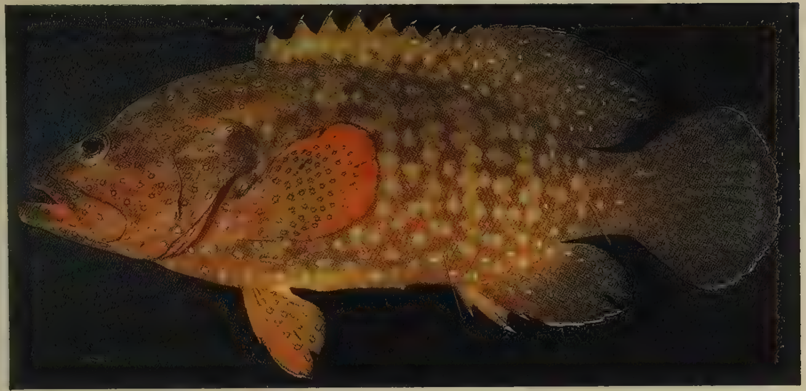
PLATE II



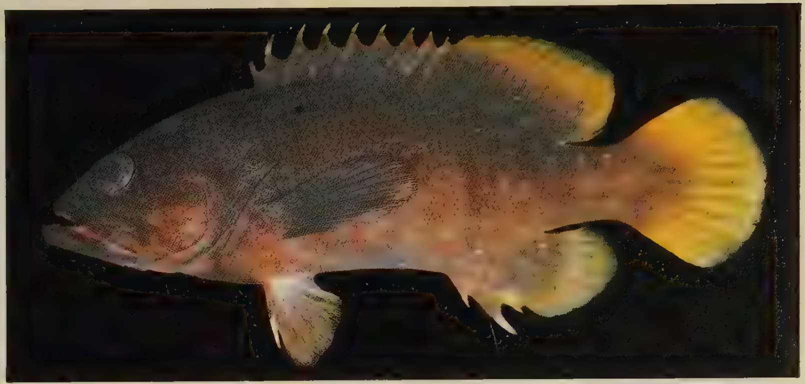
a) ***Cephalophlis boenak***, 129 mm SL, Great Barrier Reef
(J.E. Randall)



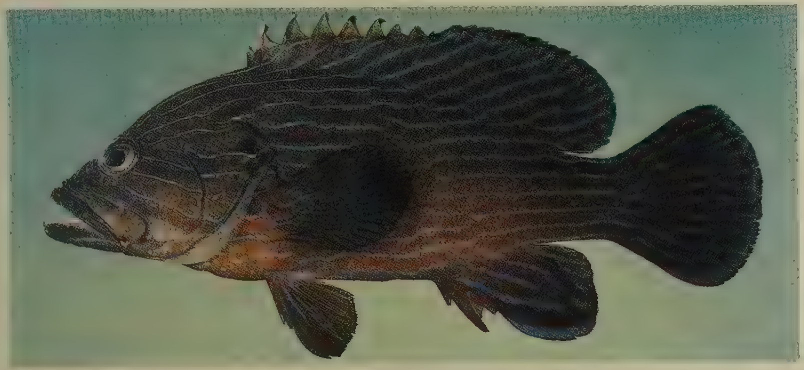
b) ***Cephalopholis cruentata***, 236 mm SL, Puerto Rico
(P.C. Heemstra)



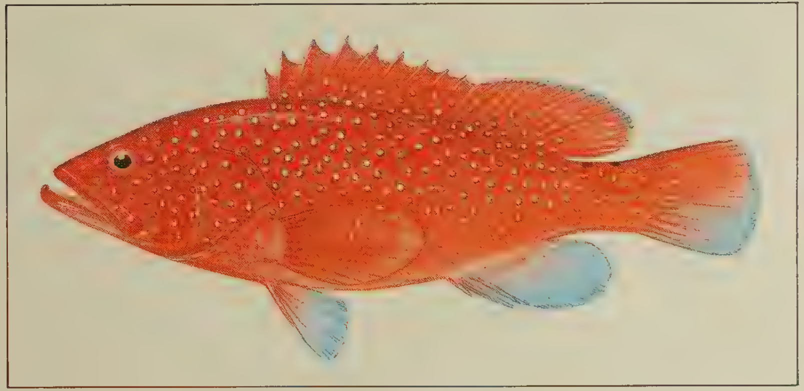
c) ***Cephalopholis cyanostigma***, 199 mm SL, Ambon, Indonesia
(J.E. Randall)



d) ***Cephalopholis cyanostigma***, 98 mm SL, Cebu, Philippines
(J.E. Randall)

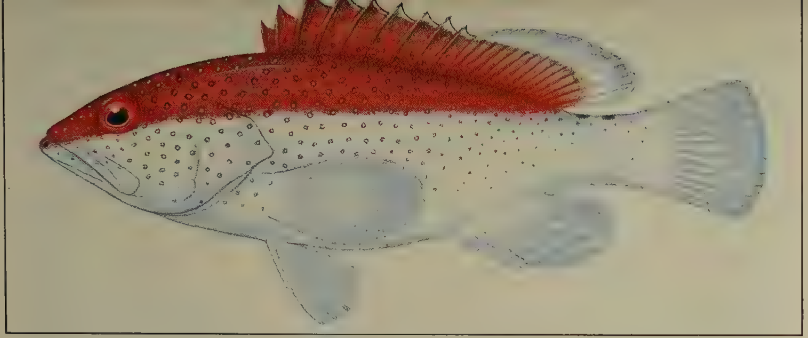


e) ***Cephalopholis formosa***, 135 mm SL, Sri Lanka
(J.E. Randall)

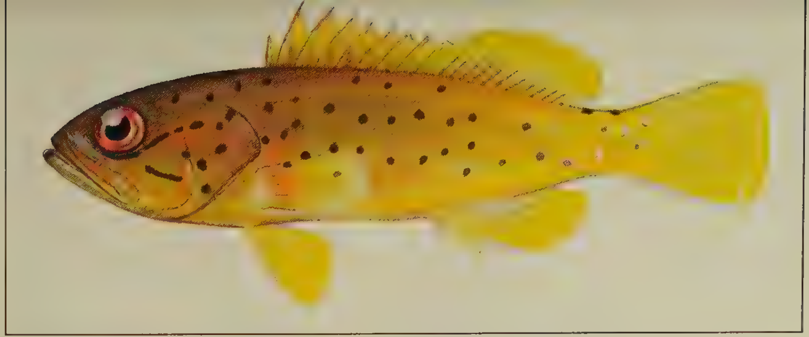


f) ***Cephalopholis fulva***, St. John, Virgin Islands
(P. Lastrico)

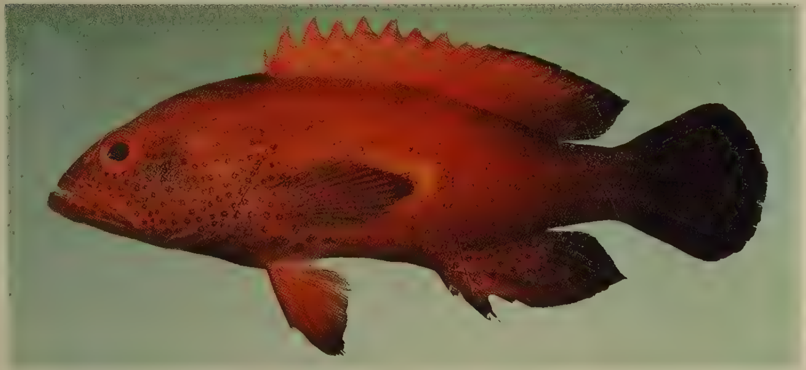
PLATE III



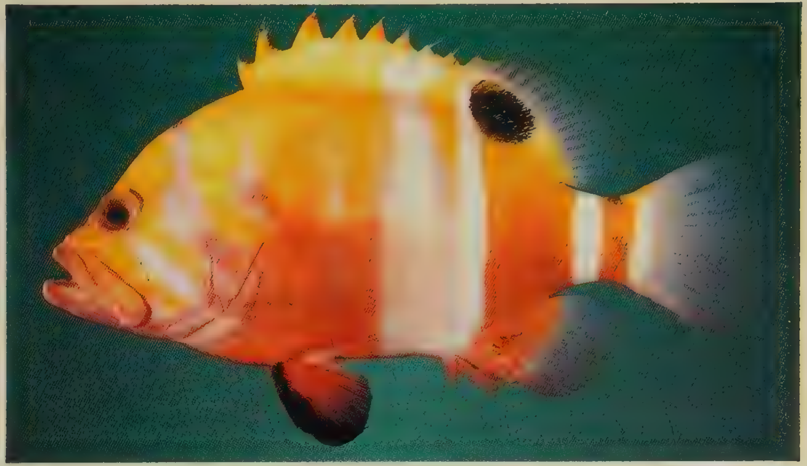
a) ***Cephalopholis fulva***, St. John, Virgin Islands
(P. Lastrico)



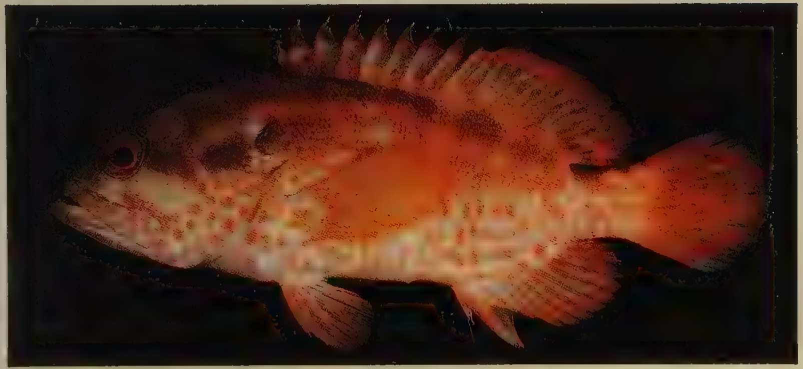
b) ***Cephalopholis fulva***, St. John, Virgin Islands
(P. Lastrico)



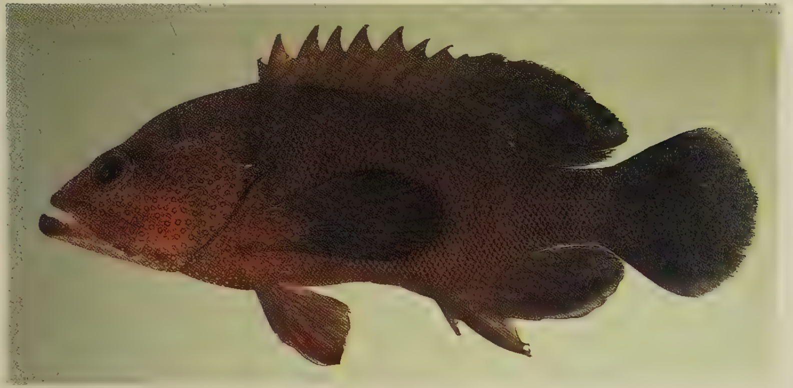
c) ***Cephalopholis hemistiktos***, 120 mm SL, Gulf of Aqaba, Red Sea
(J.E. Randall)



d) ***Cephalopholis igarashiensis***, 148 mm SL, Okinawa
(J.E. Randall)

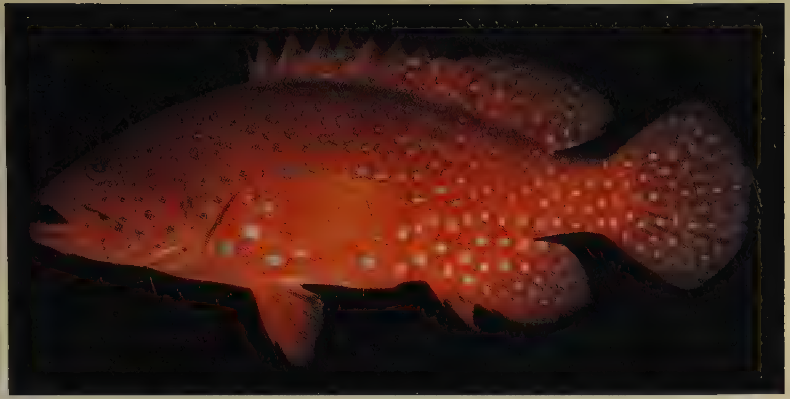


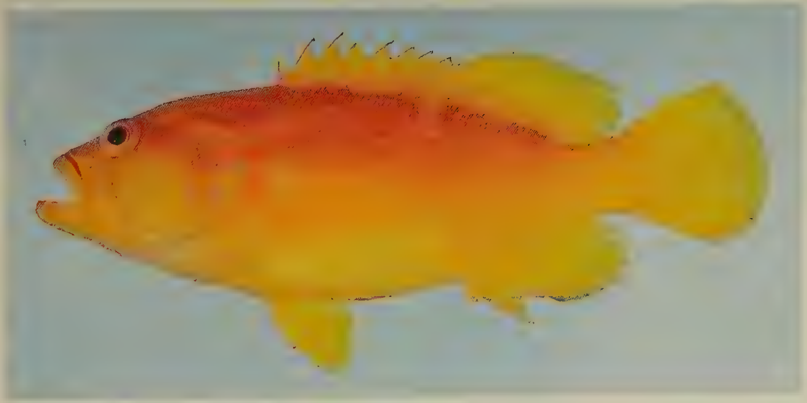
e) ***Cephalopholis leopardus***, 109 mm, Great Barrier Reef
(J.E. Randall)

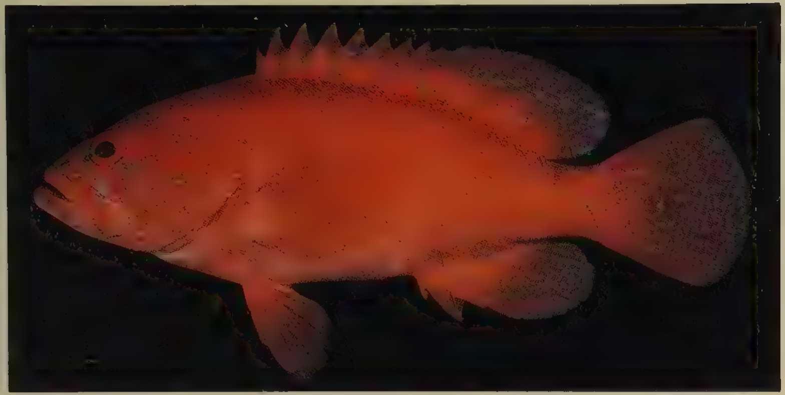


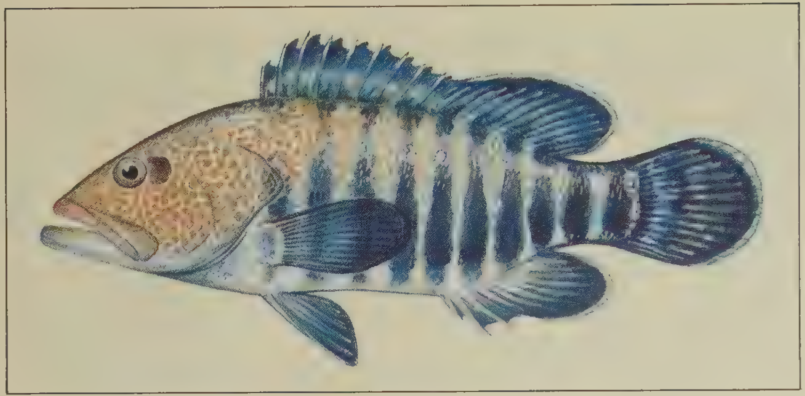
f) ***Cephalopholis microprion***, 90 mm SL, Ambon, Indonesia
(J.E. Randall)

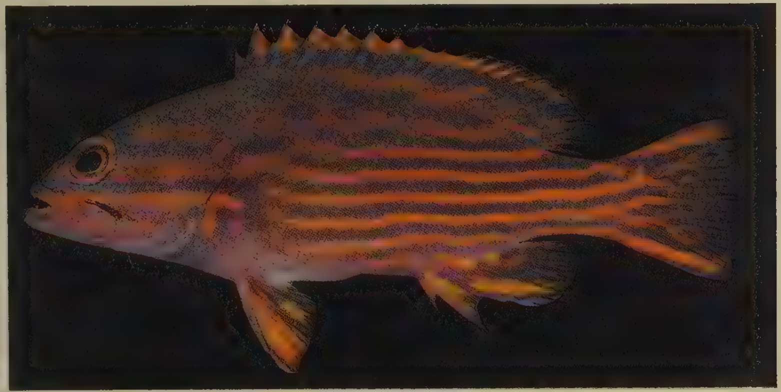
PLATE IV


a) ***Cephalopholis miniata***, 159 mm SL, Gulf of Aqaba, Red Sea
(J.E. Randall)


b) ***Cephalopholis miniata***, 98.5 mm SL, Comoros
(R. Winterbottom)


c) ***Cephalopholis oligosticta***, 172 mm SL, Sudan, Red Sea
(J.E. Randall)


d) ***Cephalopholis panamensis***, Panama
(P. Lastrico)


e) ***Cephalopholis polleni***, 94 mm SL, Kiritimati, Line Islands
(J.E. Randall)

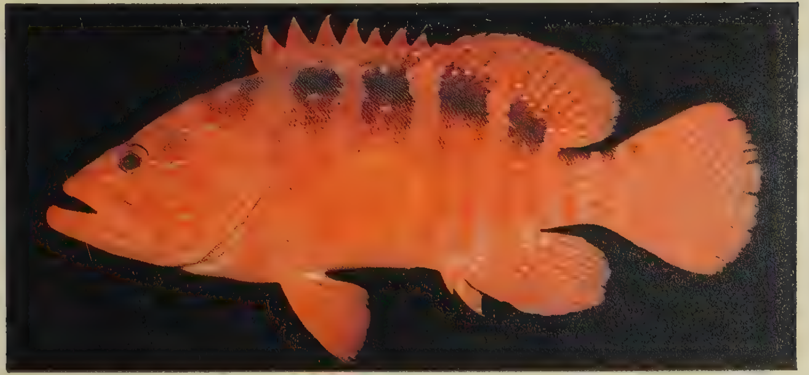
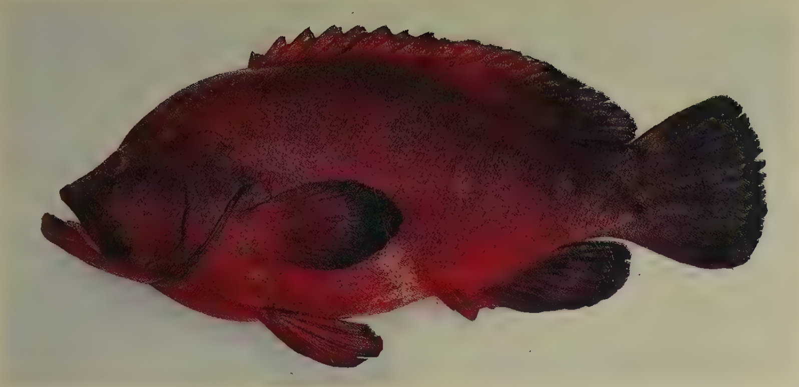
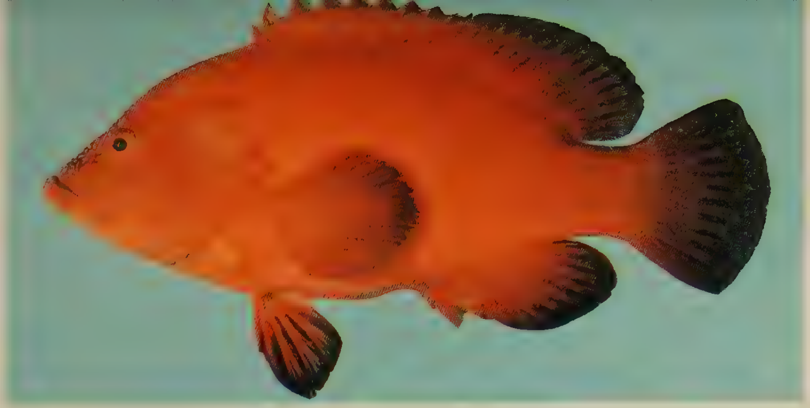

f) ***Cephalopholis sexmaculata***, 250 mm SL, Hiva Oa, Marquesas
(J.E. Randall)

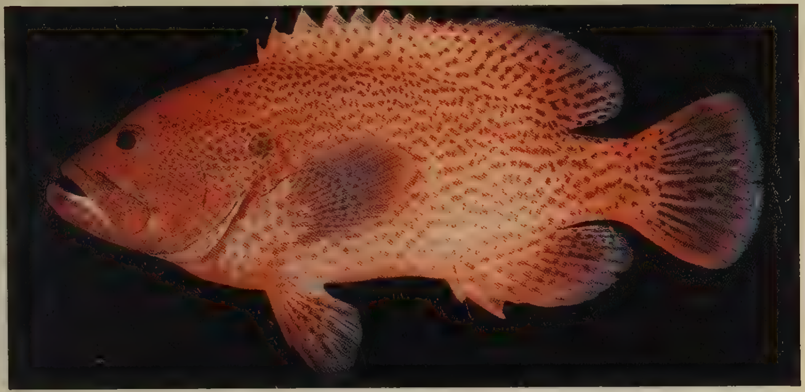
PLATE V



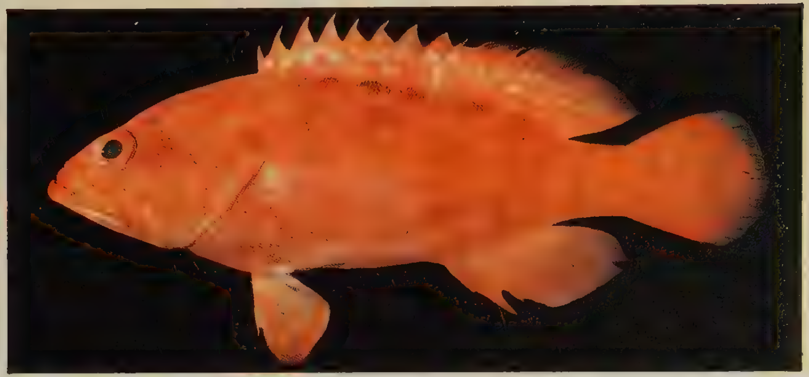
a) ***Cephalopholis sonnerati***, 337 mm SL, Mozambique
(P.C. Heemstra)



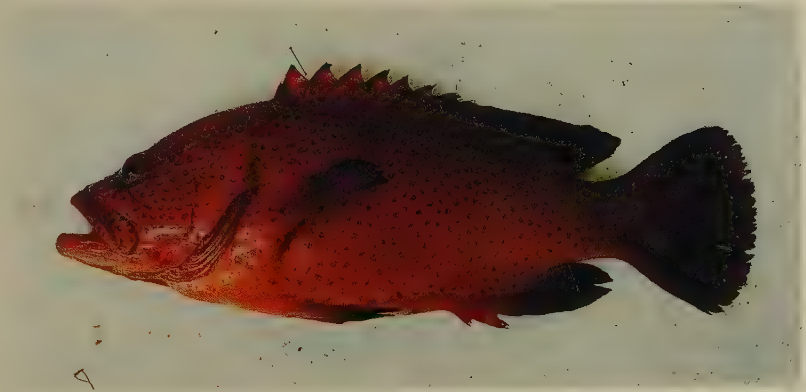
b) ***Cephalopholis sonnerati***, 211 mm SL, Mauritius
(J.E. Randall)



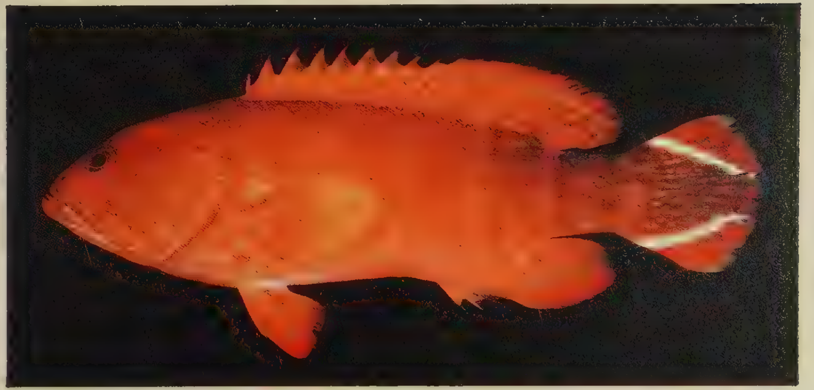
c) ***Cephalopholis sonnerati***, 158 mm SL, American Samoa
(J.E. Randall)



d) ***Cephalopholis spiloparaea***, 125 mm SL, Guam, Mariana Islands
(J.E. Randall)

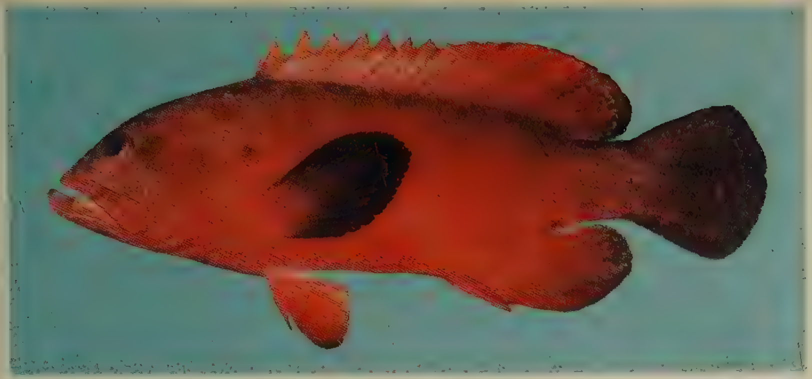


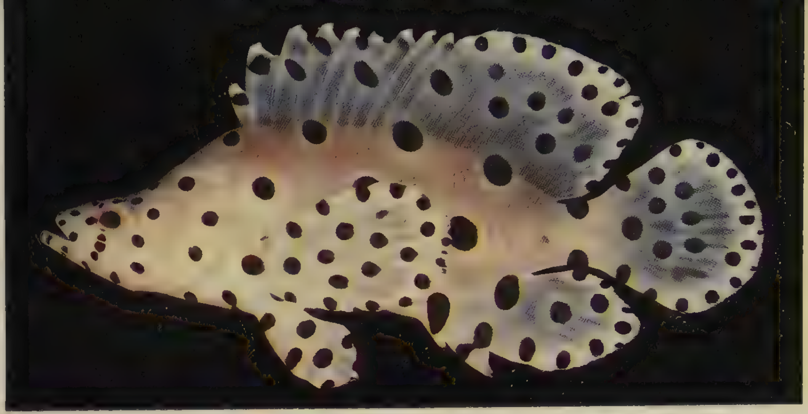
e) ***Cephalopholis taeniops***, Angola
(G. Bianchi)

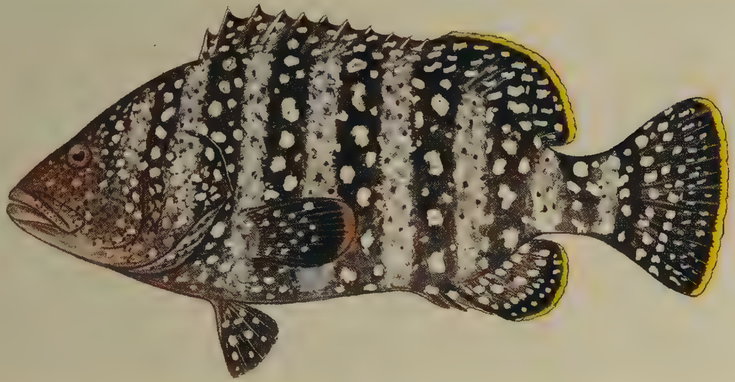


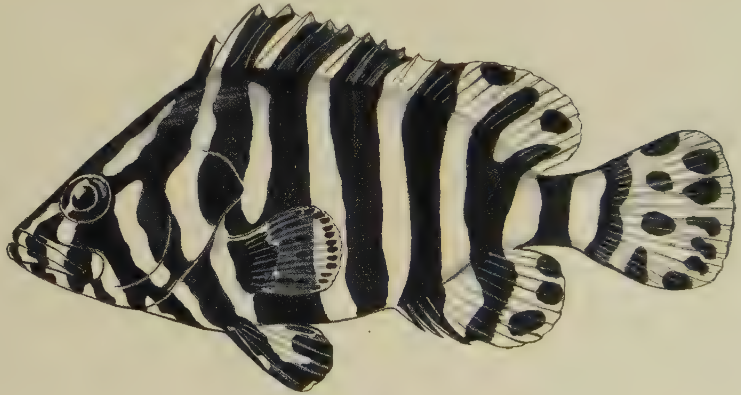
f) ***Cephalopholis urodeta***, 151 mm SL, Tetiaroa, Society Islands
(J.E. Randall)

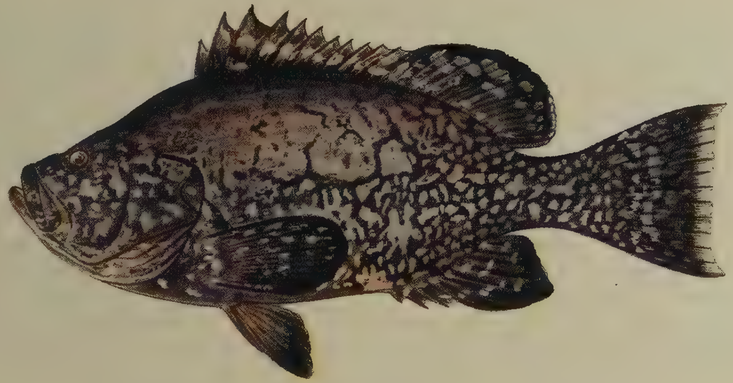
PLATE VI


a) ***Cephalopholis urodeta***, 136 mm SL, Mauritius
(J.E. Randall)


b) ***Cromileptes altivelis***, 93 mm SL, Great Barrier Reef
(J.E. Randall)


c) ***Dermatolepis dermatolepis***, Gulf of California
(P. Lastrico)


d) ***Dermatolepis dermatolepis***, Gulf of California
(P. Lastrico)


e) ***Dermatolepis inermis***,~500 mm TL, Caribbean Sea
(P. Lastrico)

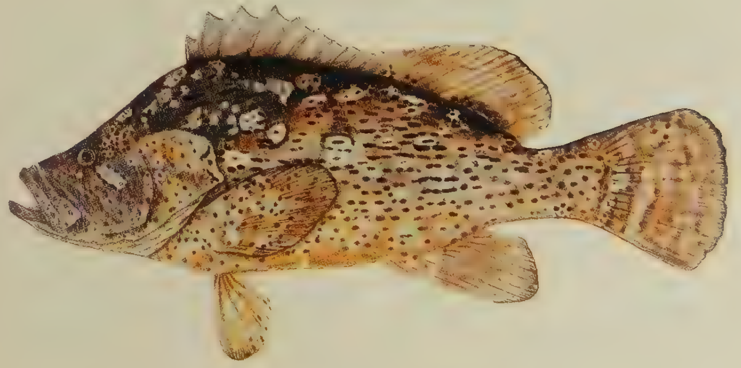
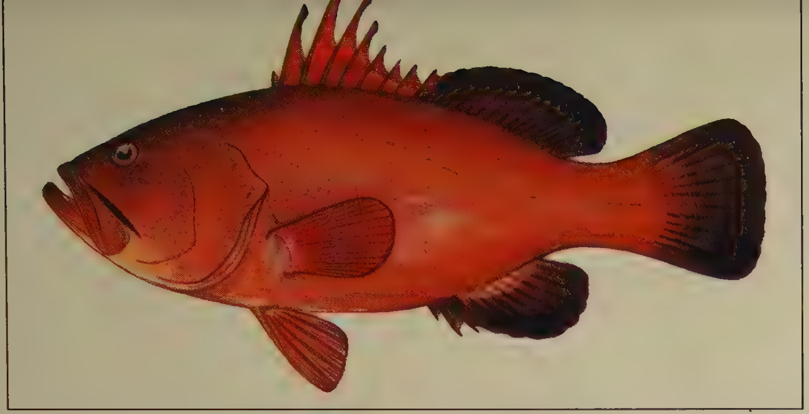
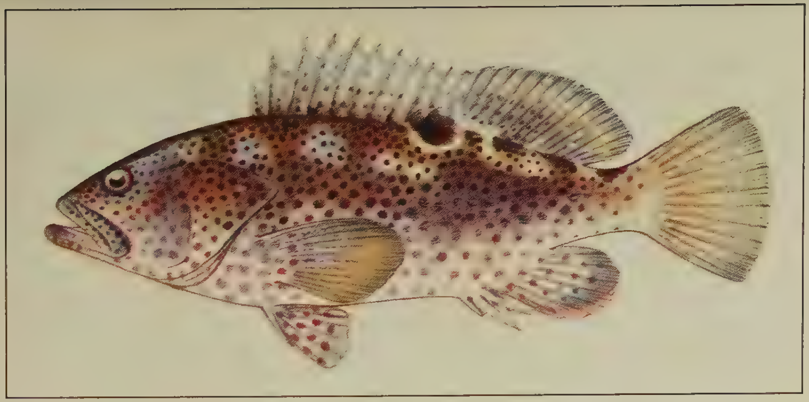

f) ***Dermatolepis striolata***, ~500 mm SL, Kenya
(Smith and Heemstra, 1986)

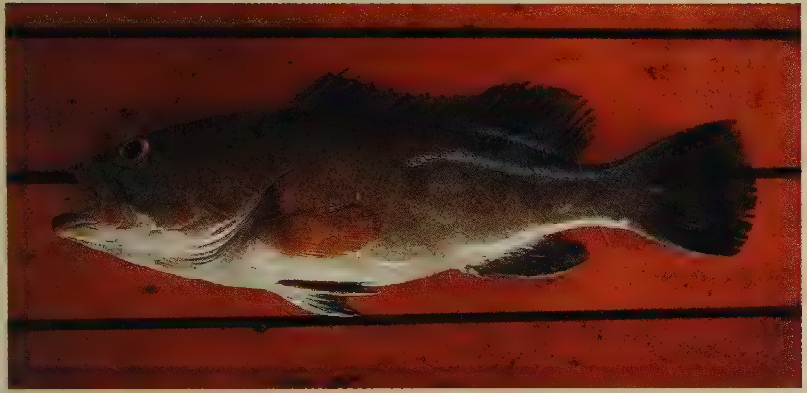
PLATE VII



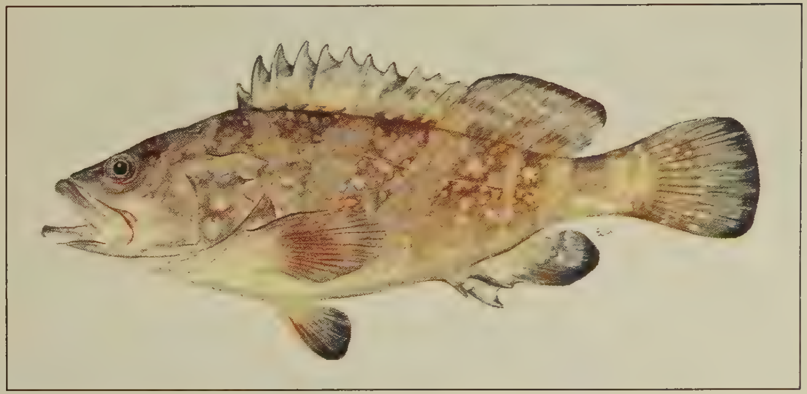
a) ***Epinephelus acanthistius***, eastern Pacific
(P. Lastrico)



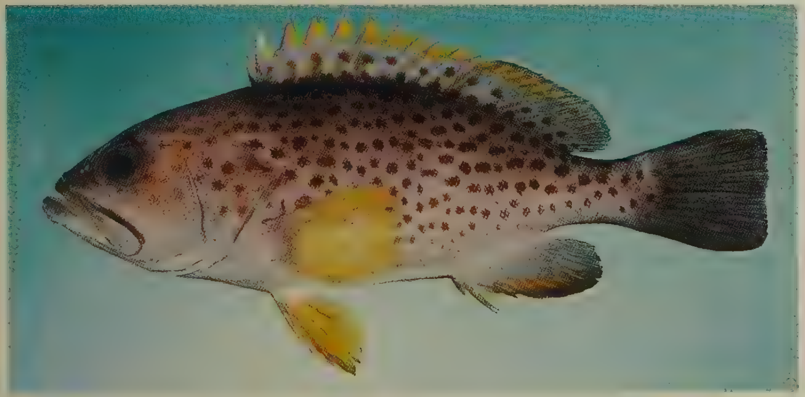
b) ***Epinephelus adscensionis***, 275 mm SL
(P. Lastrico)



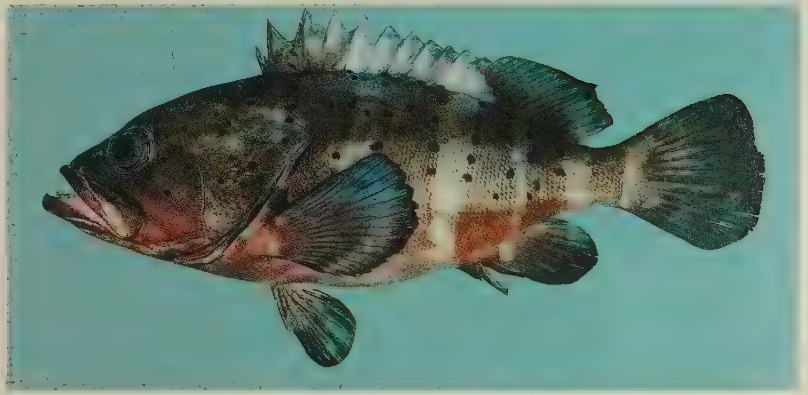
c) ***Epinephelus aeneus***, 450 mm SL, Angola
(G. Bianchi)



d) ***Epinephelus akaara***, 232 mm SL, Taiwan
(E. Heemstra)

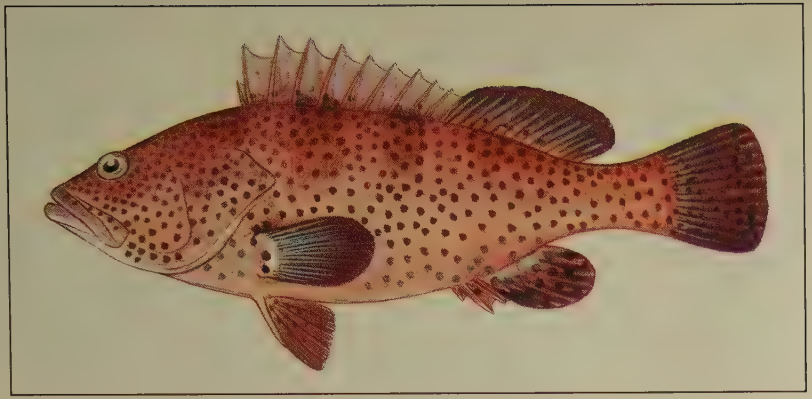


e) ***Epinephelus albomarginatus***, 192 mm SL, Natal, South Africa
(J.E. Randall)

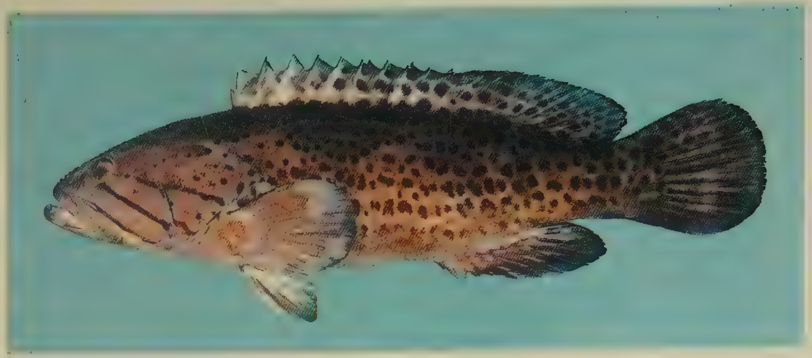


f) ***Epinephelus amblycephalus***, 314 mm SL, Negros, Philippines
(J.E. Randall)

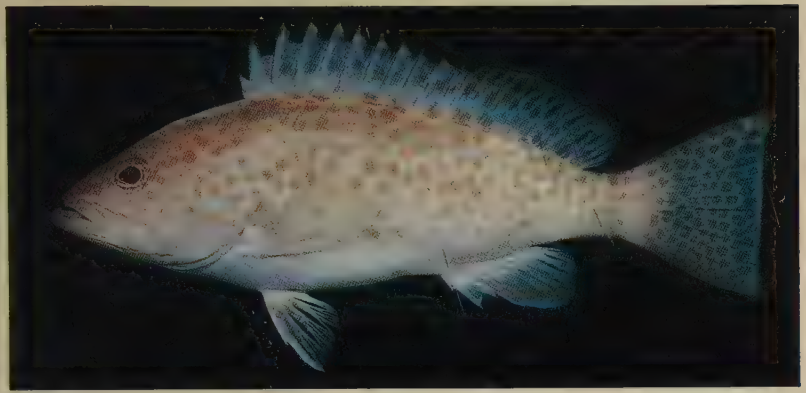
PLATE VIII



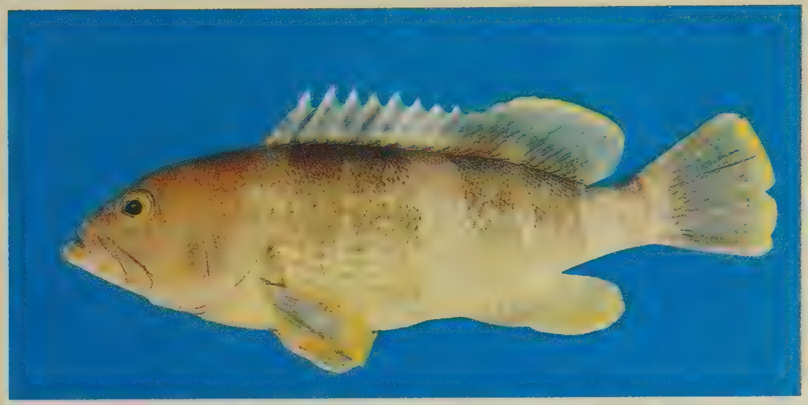
a) ***Epinephelus analogus***, ~760 mm TL, Panama
(P. Lastrico)



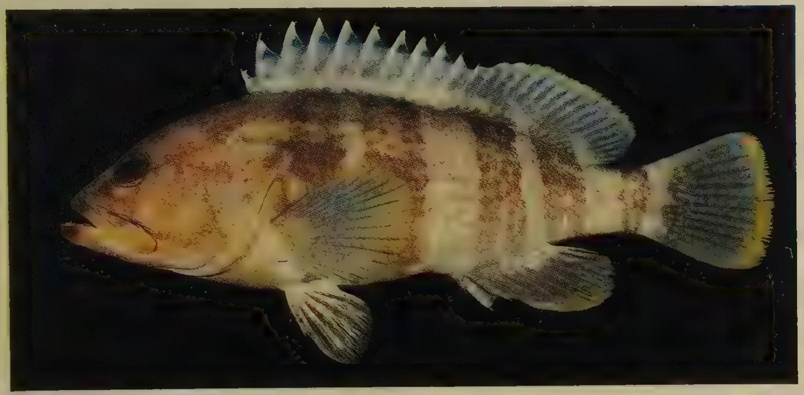
b) ***Epinephelus andersoni***, 372 mm SL, Natal, South Africa
(J.E. Randall)



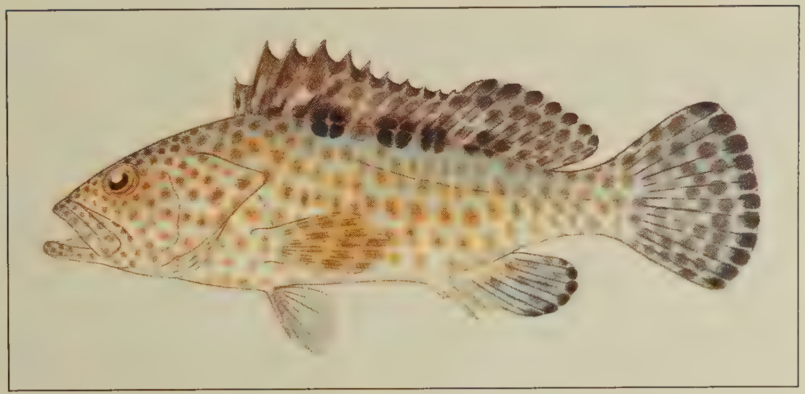
c) ***Epinephelus areolatus***, 253 mm SL, Gulf of Aqaba, Red Sea
(J.E. Randall)



d) ***Epinephelus awoara***, 301 mm SL, Makung
(RUSI)

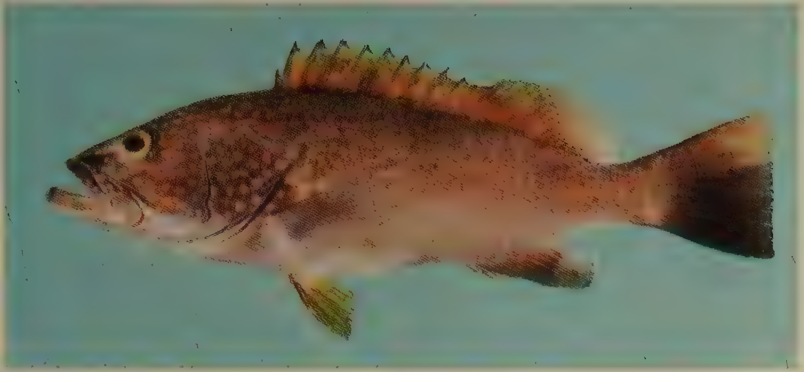


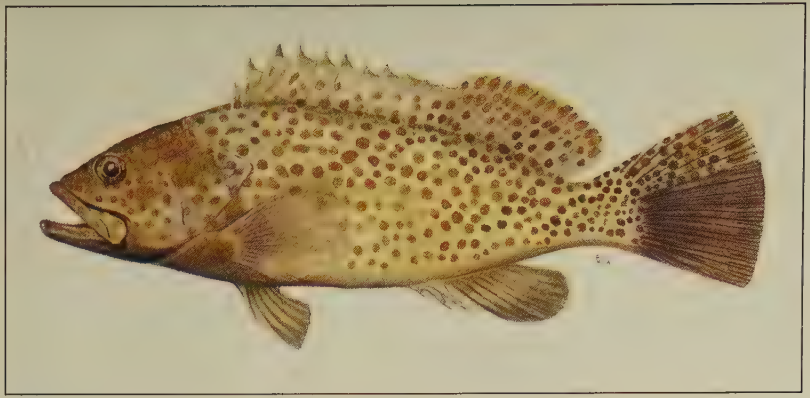
e) ***Epinephelus awoara***, 202 mm SL, Taiwan
(J.E. Randall)

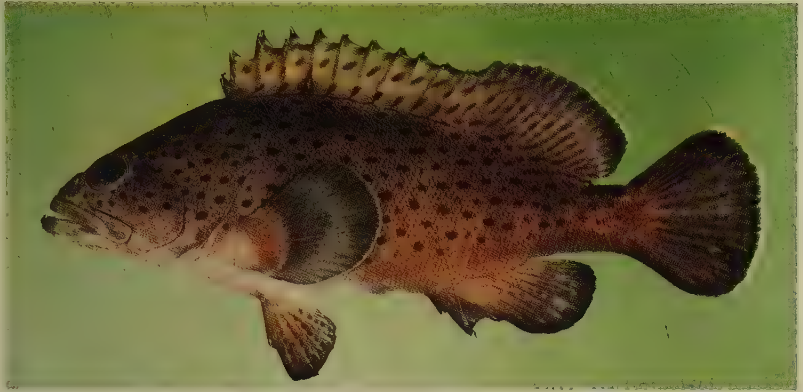


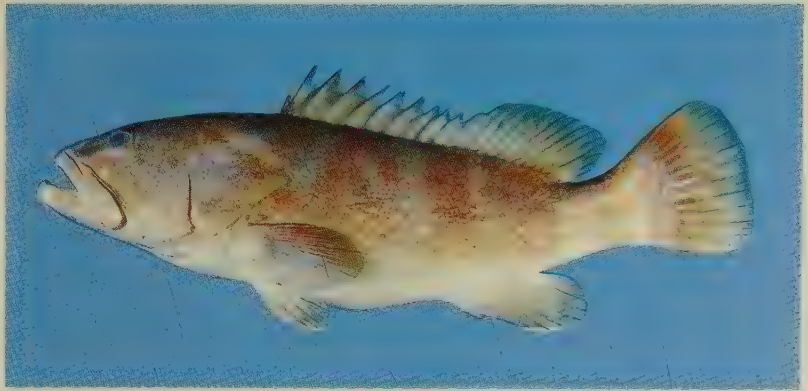
f) ***Epinephelus bilobatus***, ~230 mm TL, northwestern Australia
(P. Lastrico)

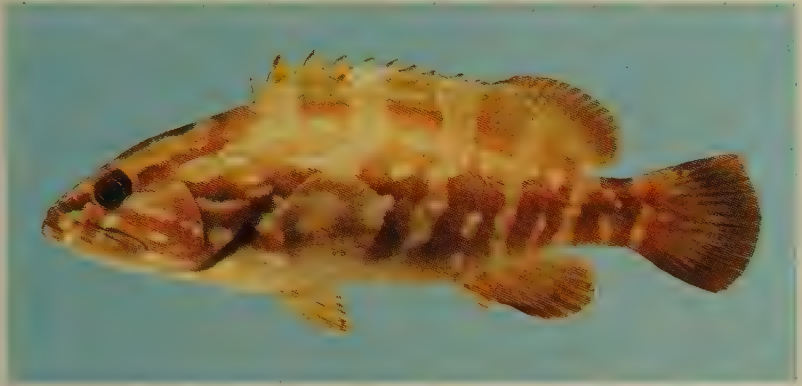
PLATE IX


a) *Epinephelus bleekeri*, 326 mm SL, Cochin, India
(J.E. Randall)


b) *Epinephelus bleekeri*, 193 mm SL, Taiwan
(E. Heemstra)


c) *Epinephelus bontoides*, 130 mm SL, Taiwan
(J.E. Randall)


d) *Epinephelus bruenus*, 437 mm SL, Penghu Islands
(P.C. Heemstra)


e) *Epinephelus bruneus*, 400 mm SL, Japan
(H. Masuda)

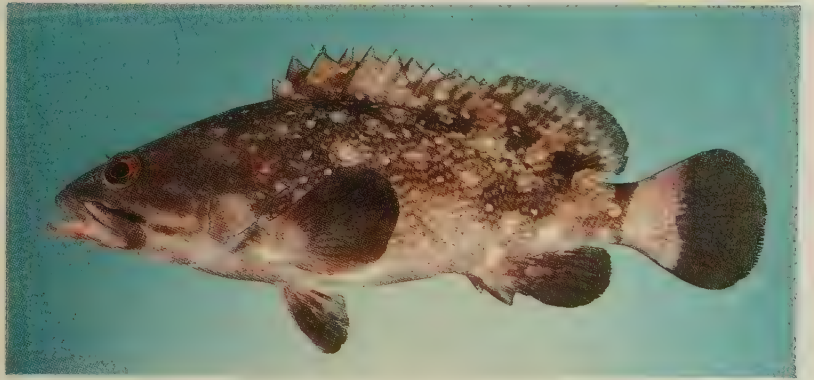
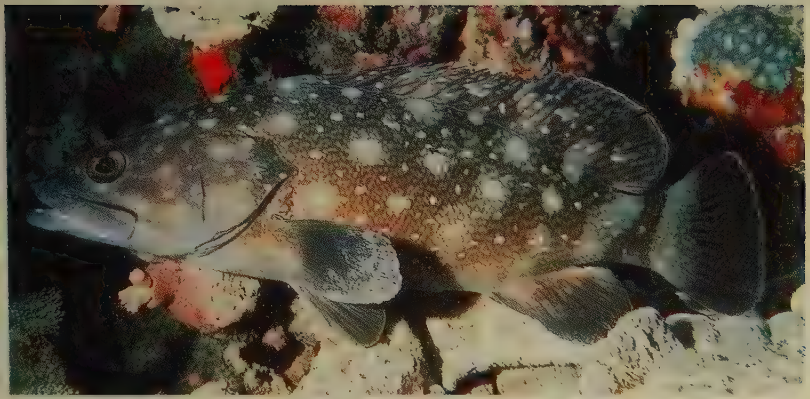
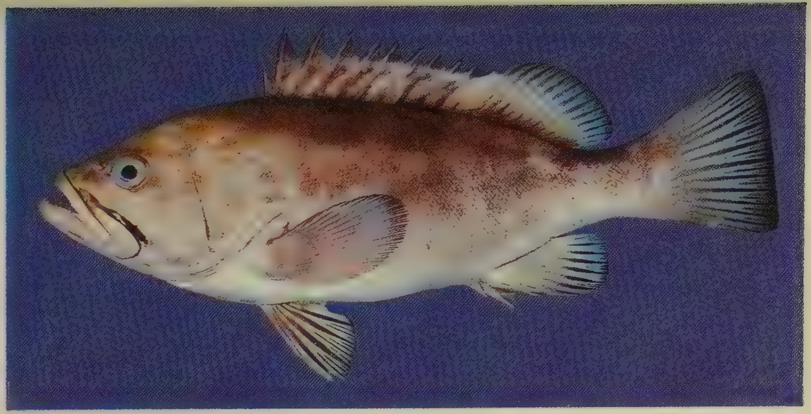

f) *Epinephelus caeruleopunctatus*, 330 mm SL, Bahrain, Persian Gulf
(J.E. Randall)

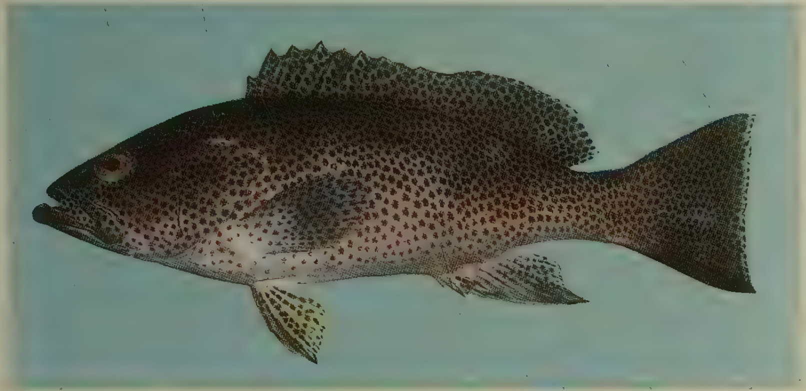
PLATE X



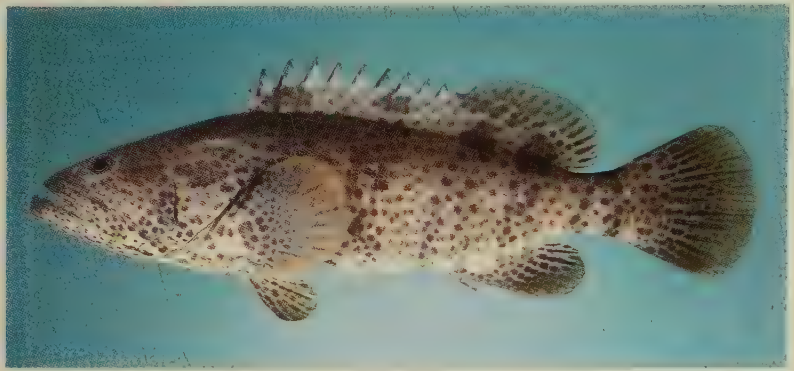
a) *Epinephelus caeruleopunctatus*, Maldives
(J.E. Randall)



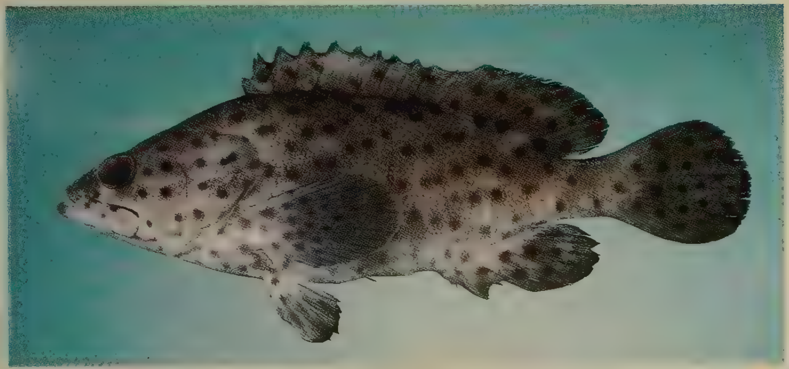
b) ***Epinephelus chabaudi***, 330 mm SL, Transkei, South Africa
(P.C. Heemstra)



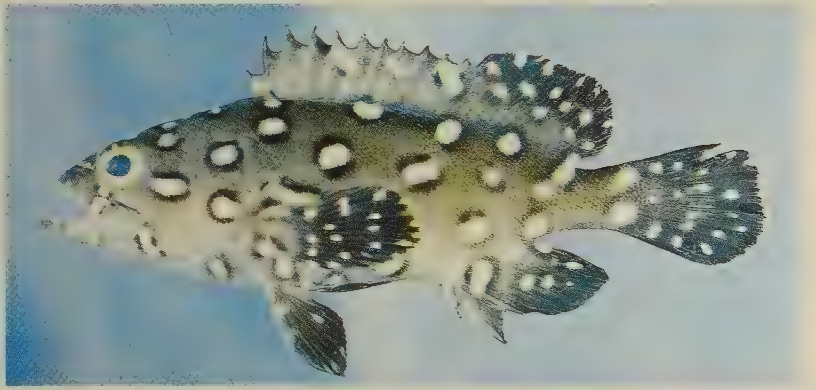
c) ***Epinephelus chlorostigma***, 327 mm SL, Sudan, Red Sea
(J.E. Randall)



d) ***Epinephelus coioides***, 323 mm SL, Bahrain, Persian Gulf
(J.E. Randall)

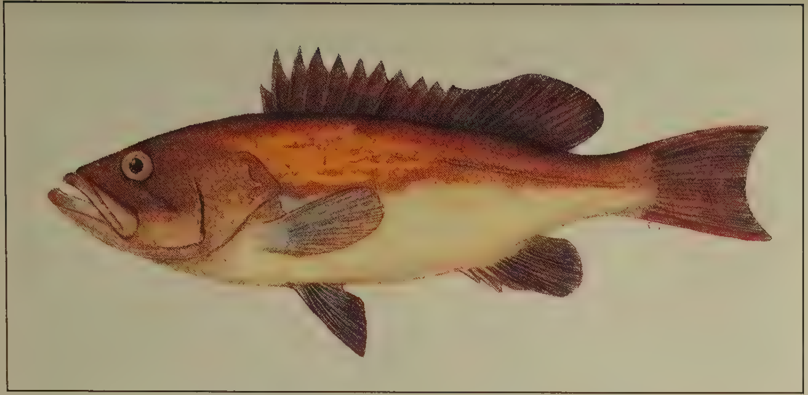


e) ***Epinephelus corallicola***, 194 mm SL, Cebu, Philippines
(J.E. Randall)

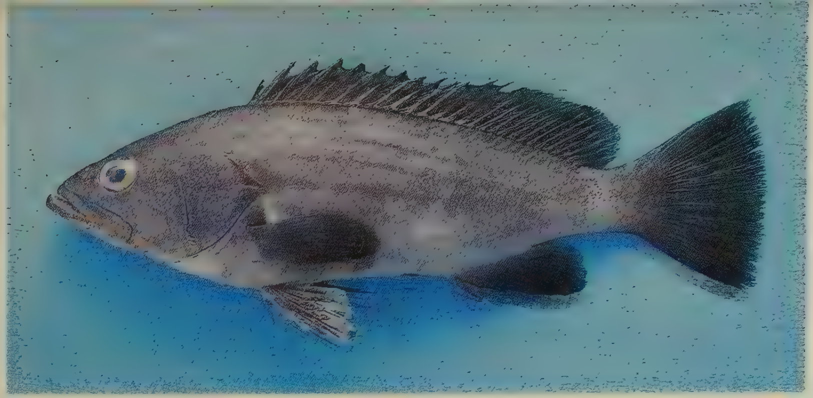


f) ***Epinephelus corallicola***, 60 mm SL, Darwin, Australia
(P.C. Heemstra)

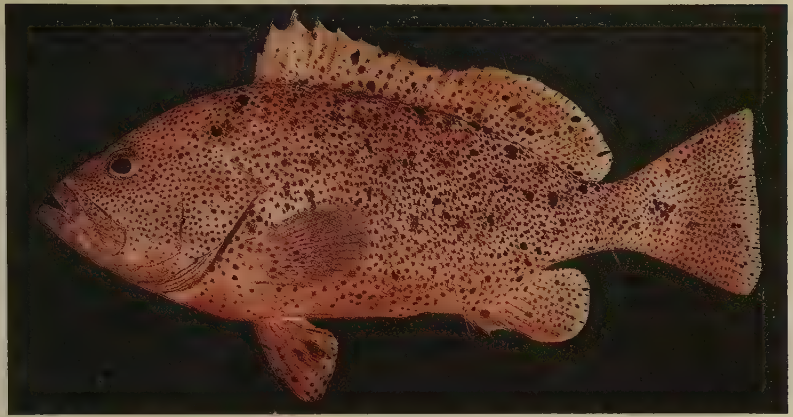
PLATE XI



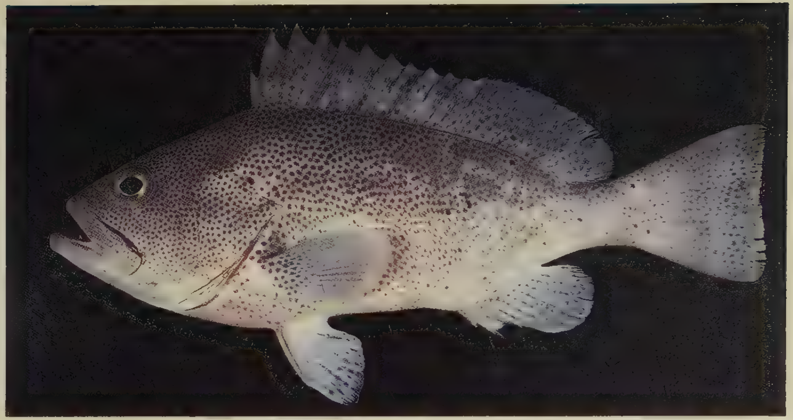
a) *Epinephelus costae*, 400 mm SL, Senegal
(E. Heemstra)



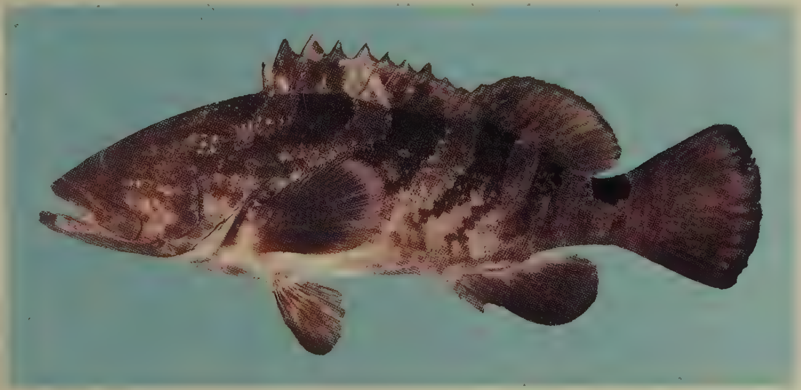
b) *Epinephelus costae*, Gambia, Senegal
(M. Bellemans)



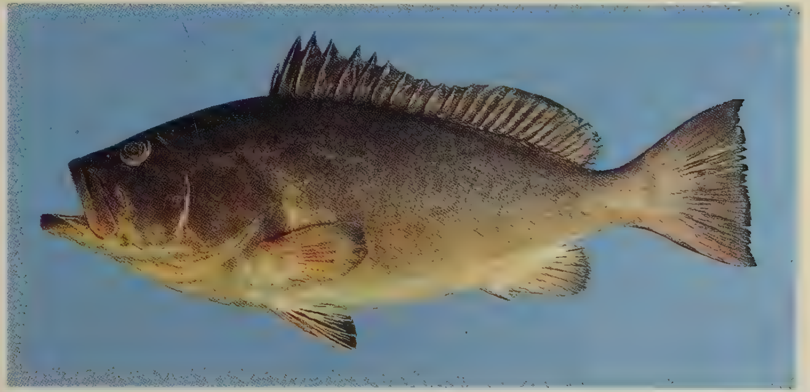
c) *Epinephelus cyanopodus*, 319 mm SL, Enewetak, Marshall Islands
(J.E. Randall)



d) *Epinephelus cyanopodus*, 180 mm SL, Enewetak, Marshall Islands
(J.E. Randall)

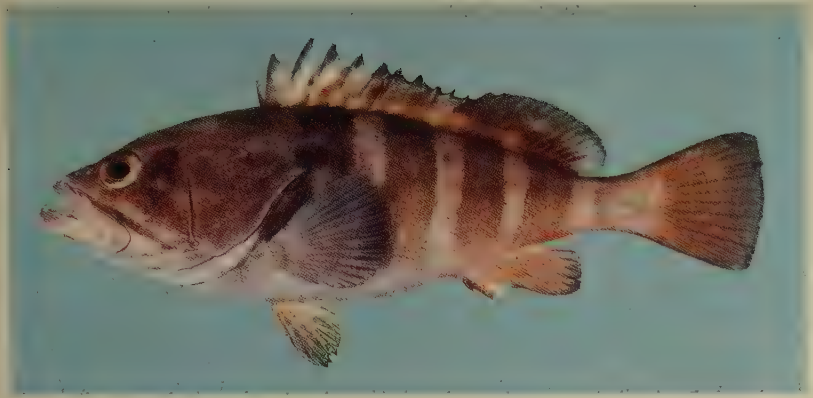


e) *Epinephelus daemelii*, 230 mm SL, Lord Howe Island
(J.E. Randall)

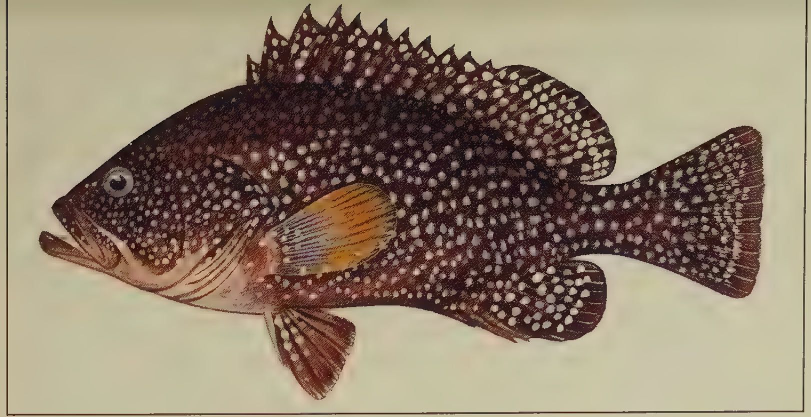


f) *Epinephelus darwinensis*, 535 mm SL, Timor Sea
(P.C. Heemstra)

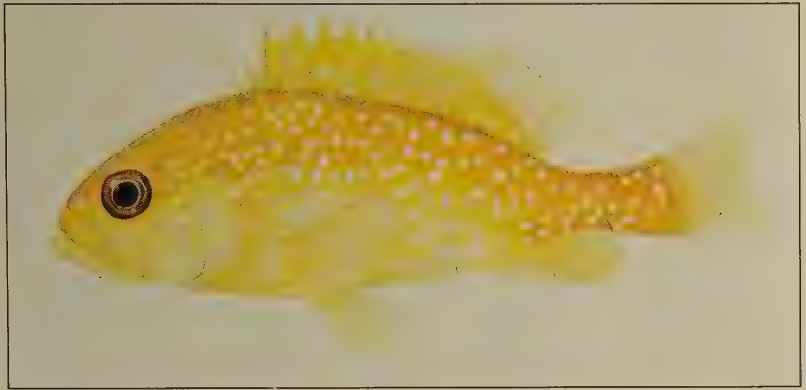
PLATE XII



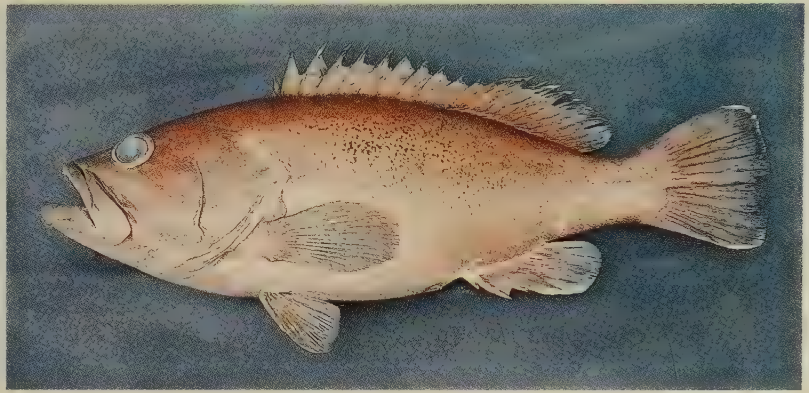
a) ***Epinephelus diacanthus***, 327 mm SL, Cochin, India
(J.E. Randall)



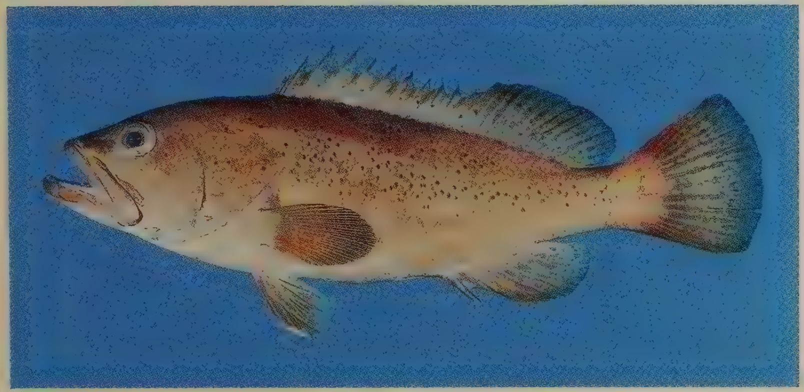
b) ***Epinephelus drummondhayi***, ~250 mm SL, USA, Atlantic Ocean
(P. Lastrico)



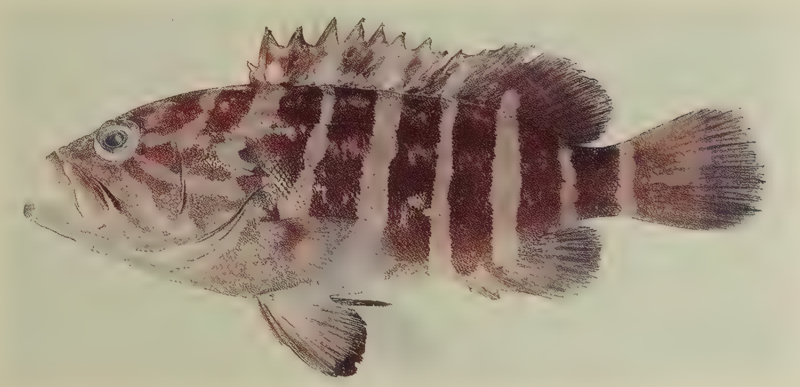
c) ***Epinephelus drummondhayi***, 100 mm SL, USA, Atlantic Ocean
[redacted]



d) ***Epinephelus epistictus***, 503 mm SL, Natal, South Africa
(P.C. Heemstra)

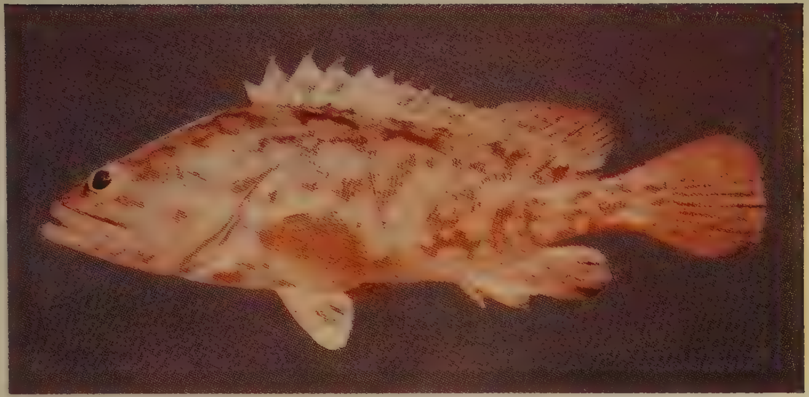


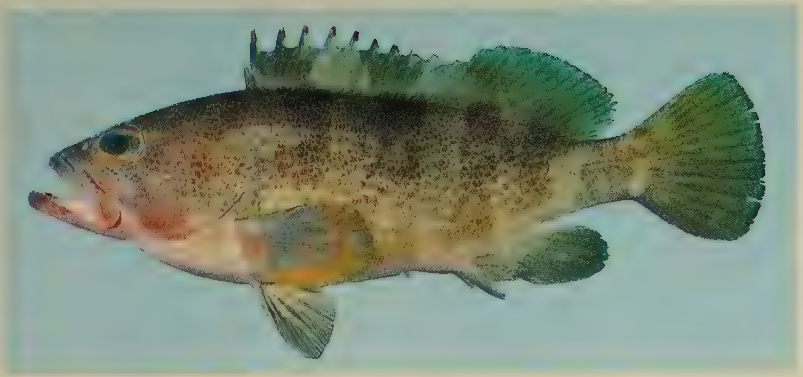
e) ***Epinephelus epistictus***, 371 mm SL, Penghu Islands
(P.C. Heemstra)

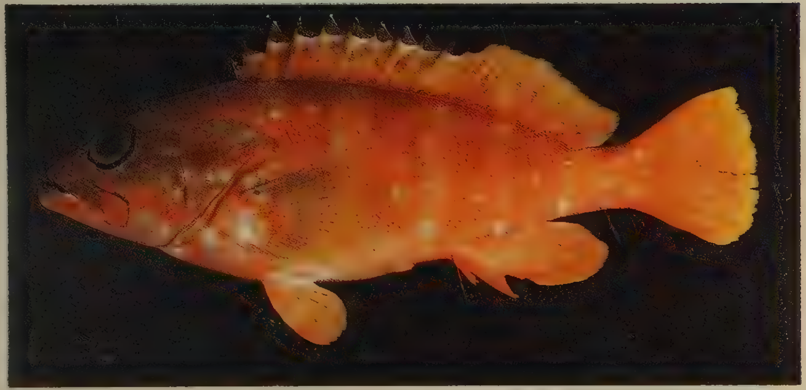


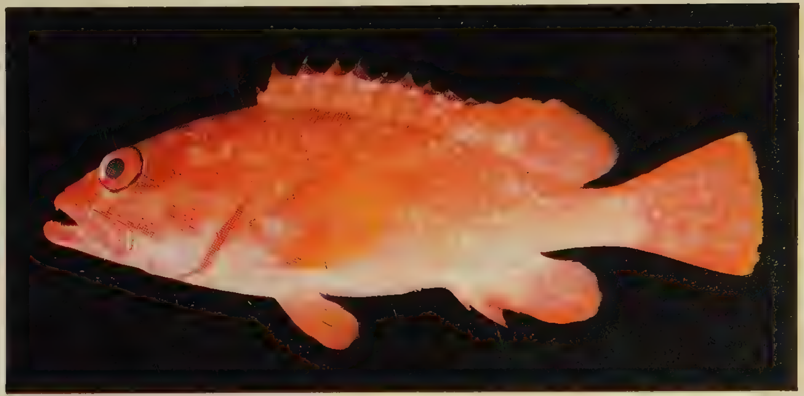
f) ***Epinephelus ergastularius***, Australia
(J.B. Hutchins)

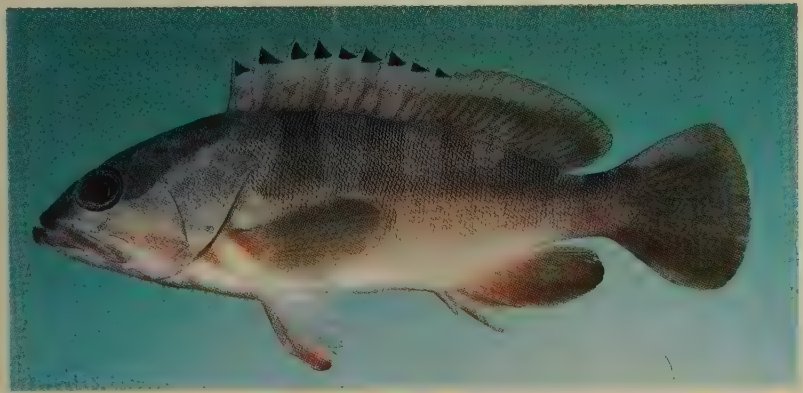
PLATE XIII


a) *Epinephelus erythrurus*, 219 mm SL, Gulf of Thailand
(R. Rofen)


b) *Epinephelus fasciatomaculosus*, 205 mm SL, Taiwan
(P.C. Heemstra)


c) *Epinephelus fasciatus*, 218 mm SL, Nuku Hiva, Marquesas
(J.E. Randall)


d) *Epinephelus fasciatus*, 207 mm SL, Tahiti, Society Islands
(J.E. Randall)


e) *Epinephelus fasciatus*, 151 mm SL, Gulf of Aqaba, Red Sea
(J.E. Randall)

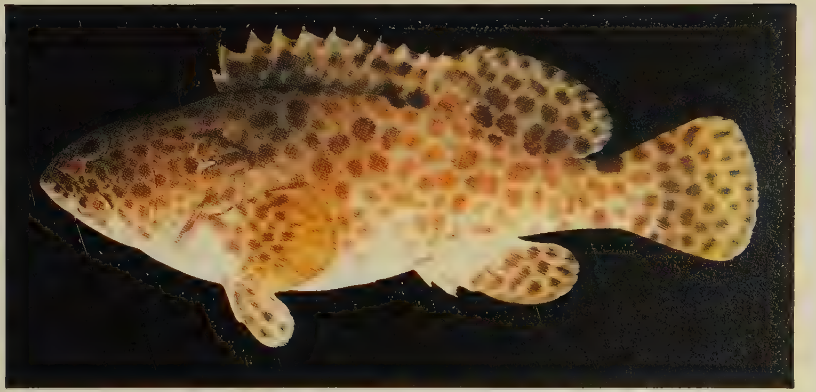
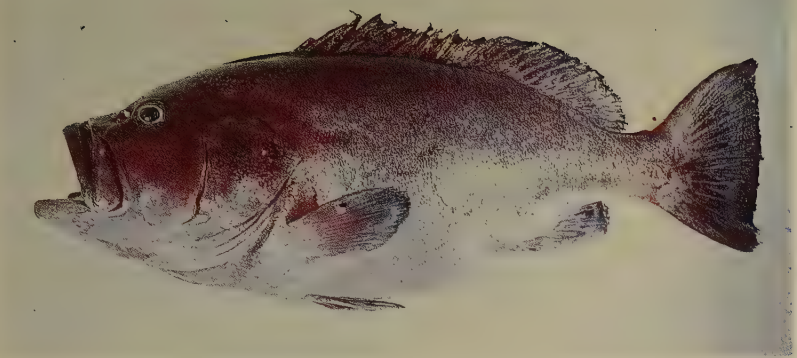
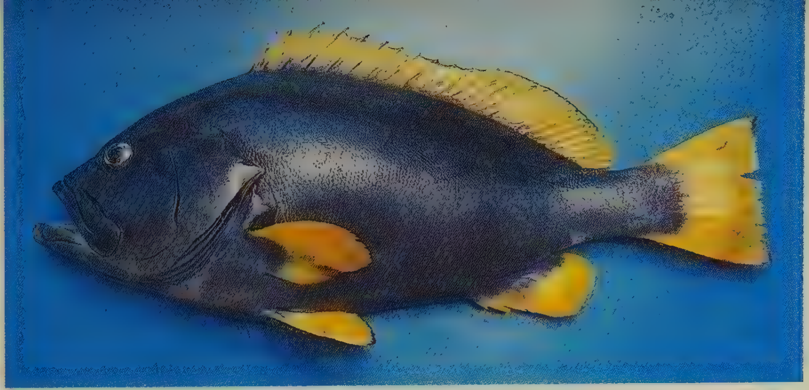

f) *Epinephelus faveatus*, 209 mm SL, Kovalam, India
(J.E. Randall)

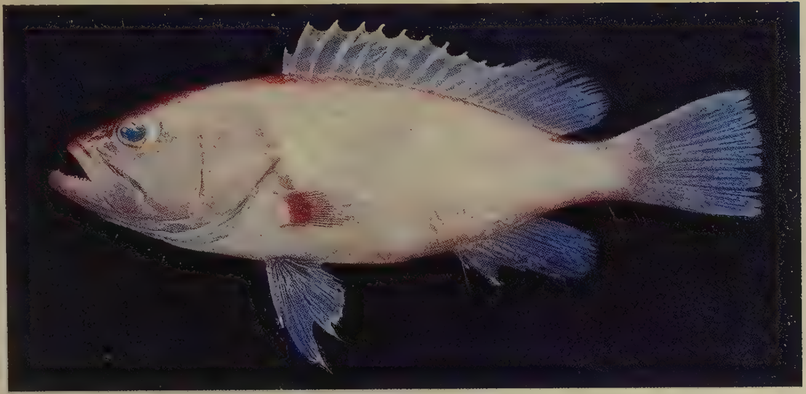
PLATE XIV



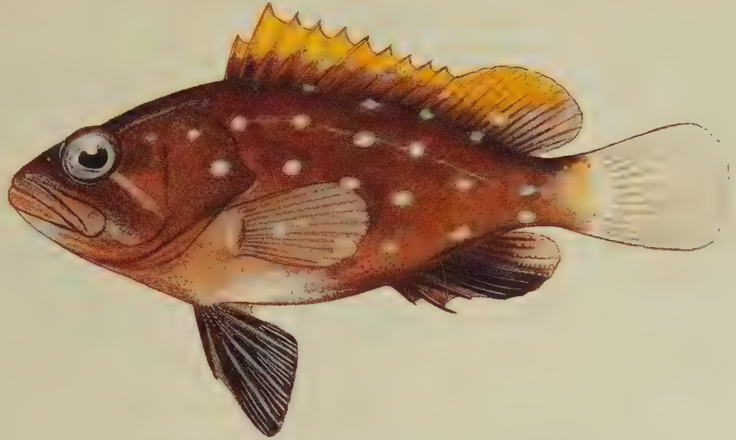
a) ***Epinephelus flavocaeruleus***, 660 mm SL, Kenya
(P.C. Heemstra)



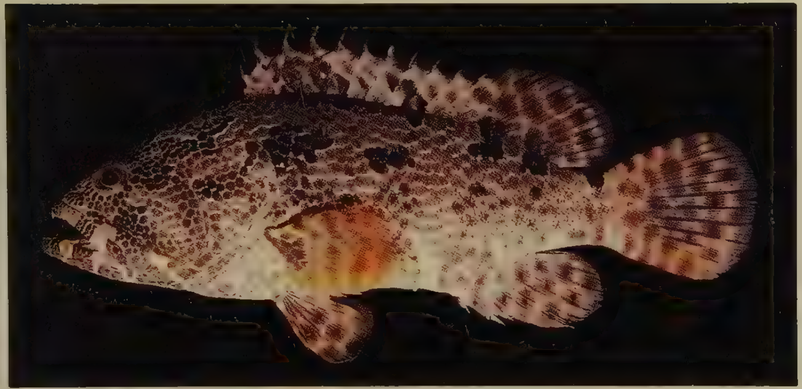
b) ***Epinephelus flavocaeruleus***, 410 mm SL, Natal, South Africa
(S. Chater)



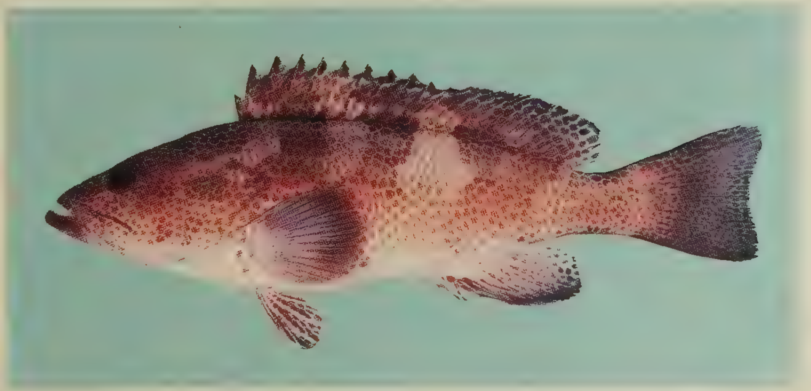
c) ***Epinephelus flavolimbatus***, Suriname, Trinidad
(J. Kolding)



d) ***Epinephelus flavolimbatus***, 30 mm SL, USA, Atlantic Ocean
(P. Lastrico)

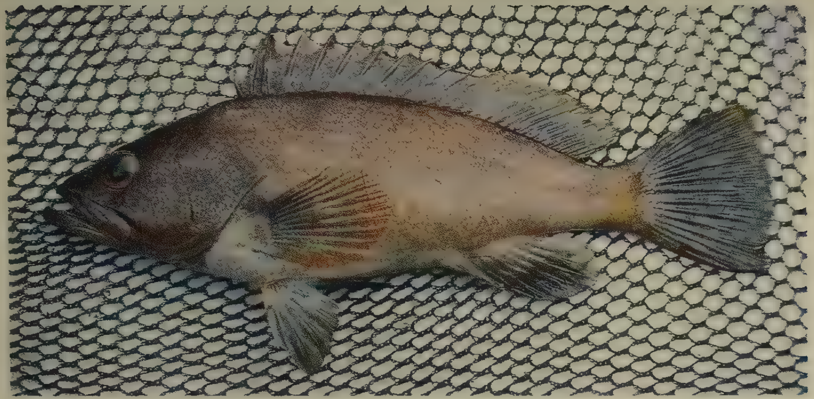


e) ***Epinephelus fuscoguttatus***, 120 mm SL, Sulawesi, Indonesia
(J.E. Randall)

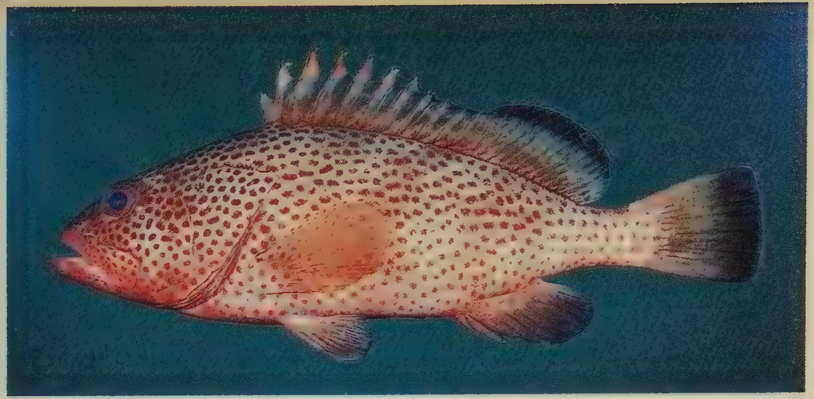


f) ***Epinephelus gabriellae***, 224 mm SL, southern Oman
(J.E. Randall)

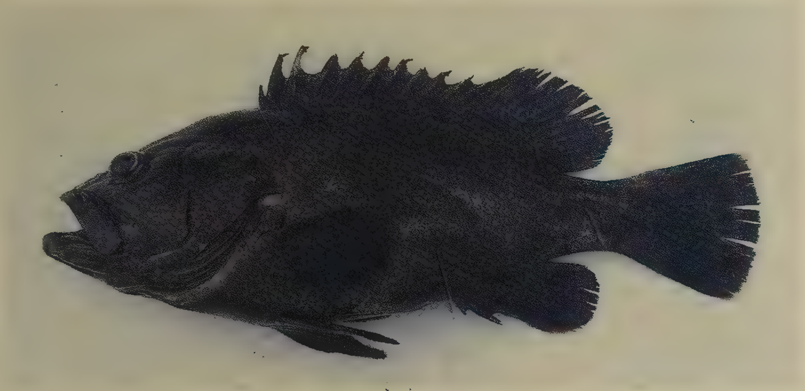
PLATE XV



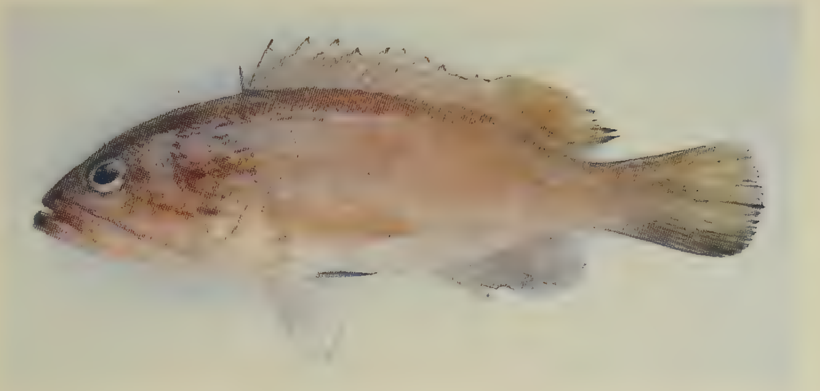
a) *Epinephelus goreensis*, Senegal
(M. Bellemans)



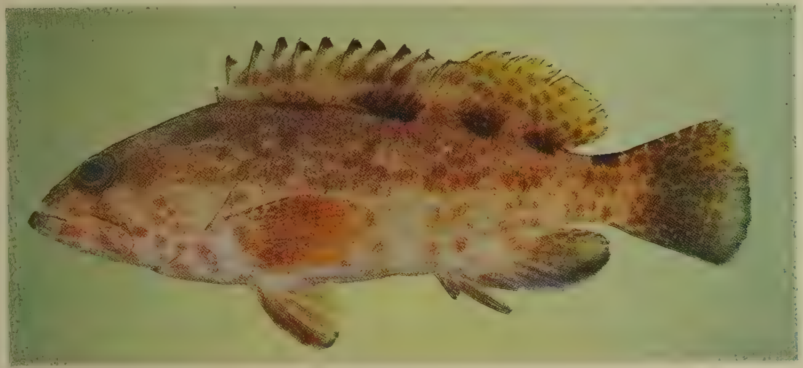
b) *Epinephelus guttatus*, 25 cm SL, St. John, Virgin Islands
(J.E. Randall)



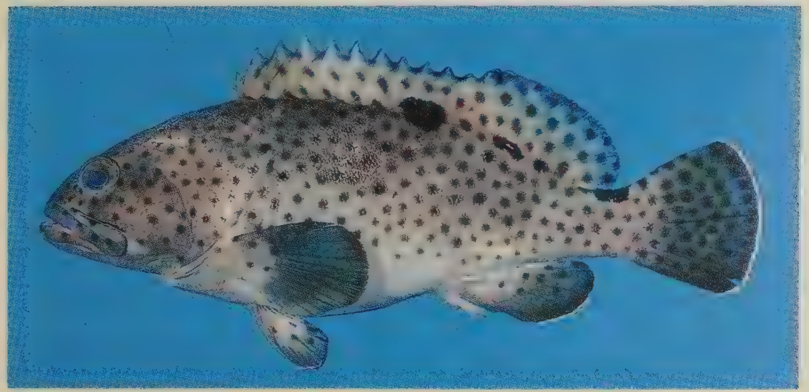
c) *Epinephelus haifensis*, 326 mm SL, Angola
(W. Schneider)



d) *Epinephelus heniochus*, 200 mm SL, southern Japan
(H. Masuda)

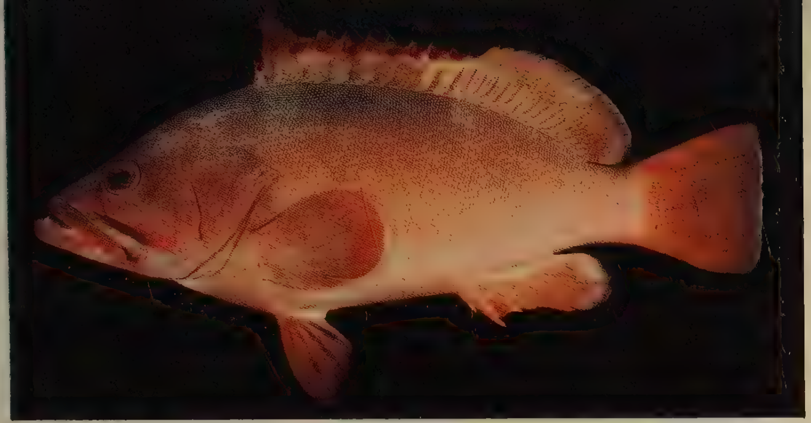


e) *Epinephelus hexagonatus*, 160 mm SL, Enewetak, Marshall Islands
(J.E. Randall)

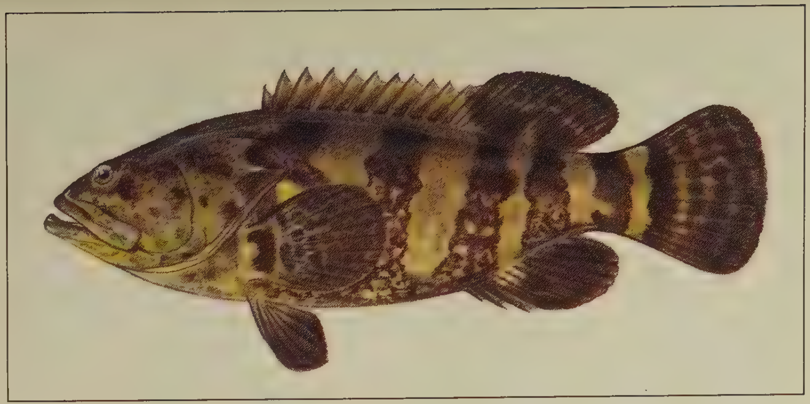


f) *Epinephelus howlandi*, 268 mm SL, Naha, Okinawa
(P.C. Heemstra)

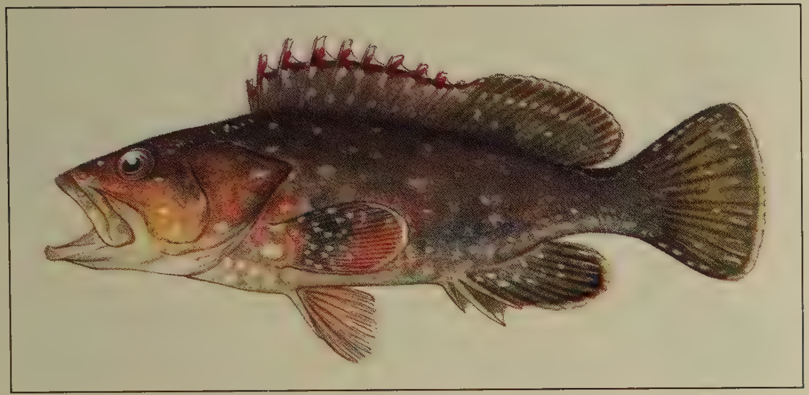
PLATE XVI



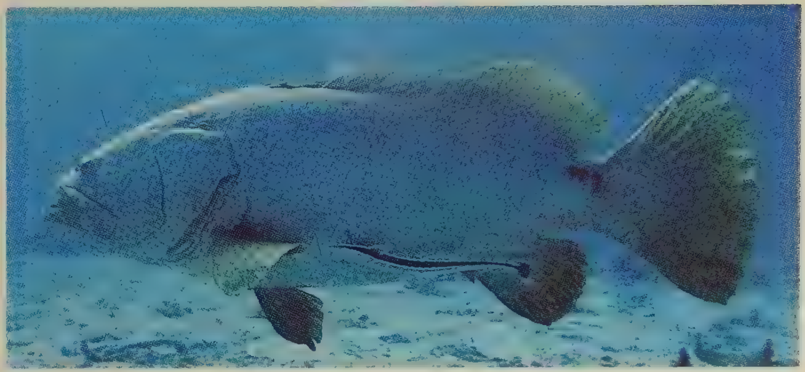
a) ***Epinephelus irrotatus***, 277 mm SL, Ua Huka, Marquesas
(J.E. Randall)



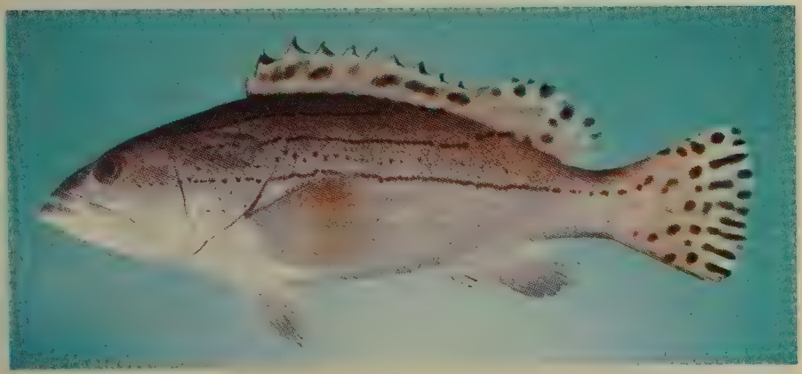
b) ***Epinephelus itajara***, 520 mm SL
(P. Lastrico)



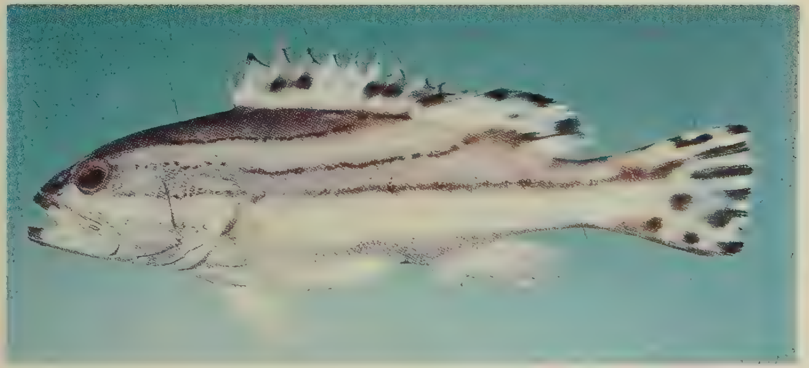
c) ***Epinephelus labriformis***, ~130 mm TL
(P. Lastrico)



d) ***Epinephelus lanceolatus***, ~1700 mm SL, Frederick Reef, Coral Sea
(R. Taylor)

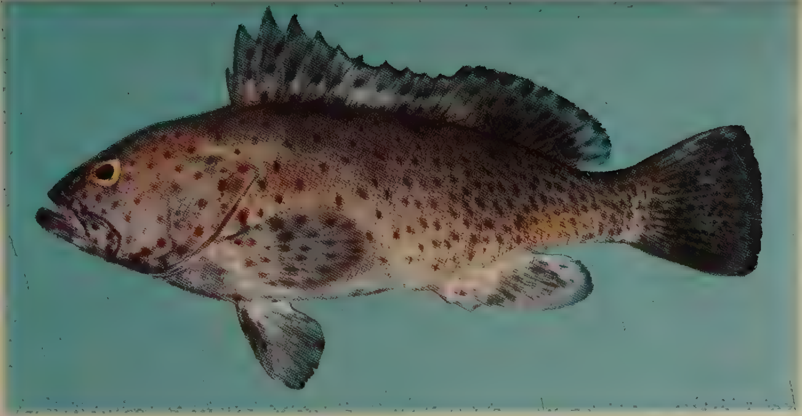


e) ***Epinephelus latifasciatus***, 273 mm SL, Cochin, India
(J.E. Randall)

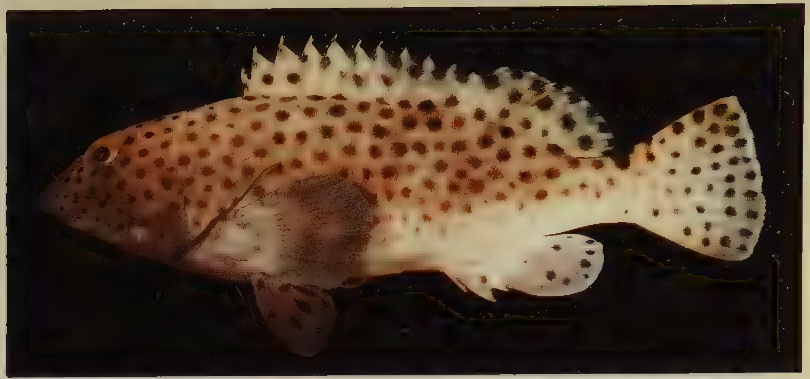


f) ***Epinephelus latifasciatus***, 168 mm SL, Bahrain, Persial Gulf
(J.E. Randall)

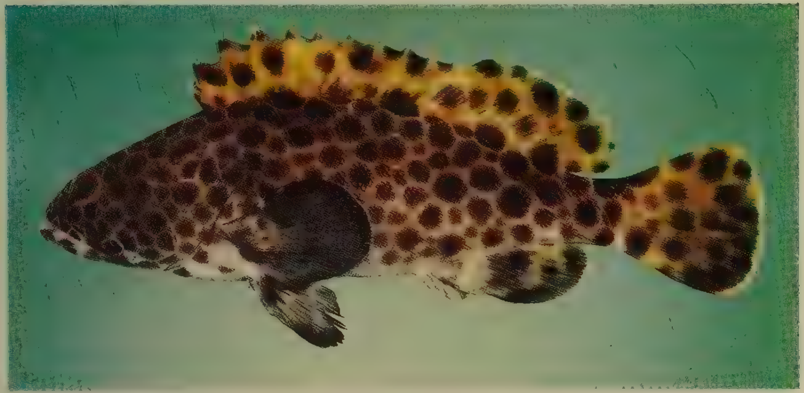
PLATE XVII



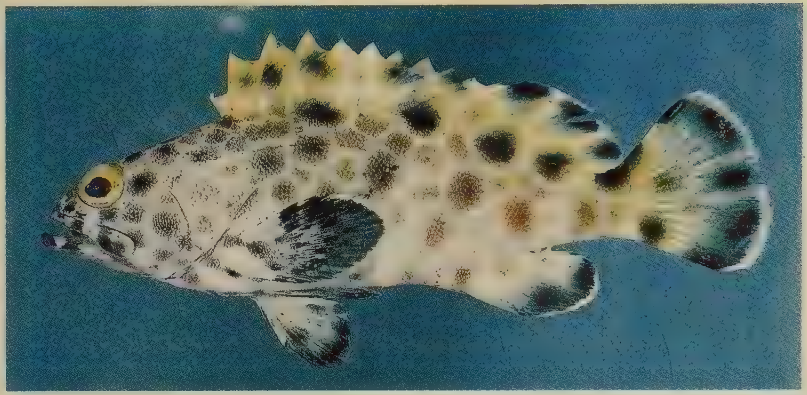
a) *Epinephelus longispinis*, 298 mm SL, Lombok, Indonesia (J.E. Randall)



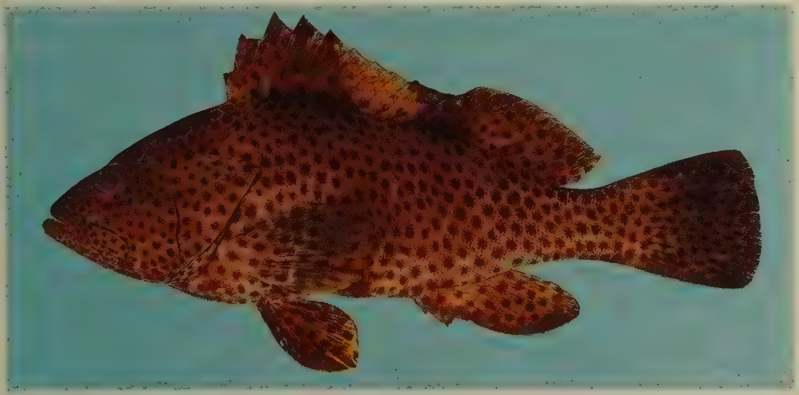
b) *Epinephelus macrospilos*, 290 mm SL, Palmyra, Line Islands (J.E. Randall)



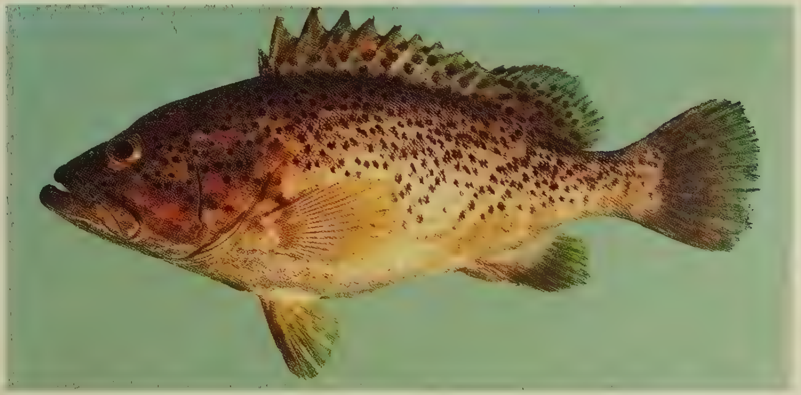
c) *Epinephelus macrospilos*, 186 mm SL, Natal, South Africa (J.E. Randall)



d) *Epinephelus macrospilos*, 73 mm SL, Peros Banhos, Chagos Archipelago

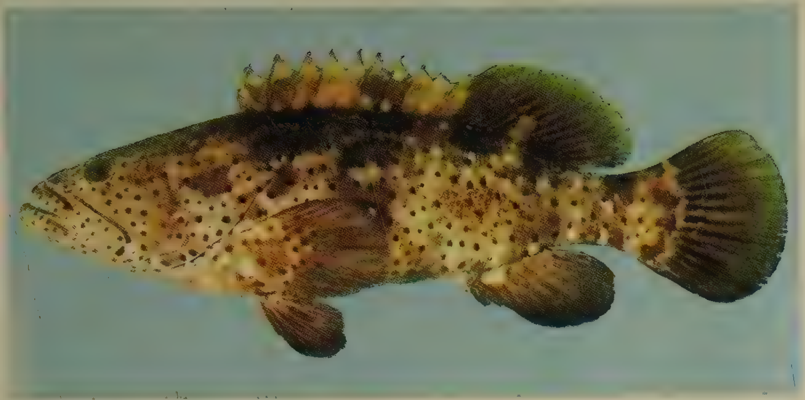


e) *Epinephelus maculatus*, 251 mm SL, Enewetak, Marshall Islands (J.E. Randall)

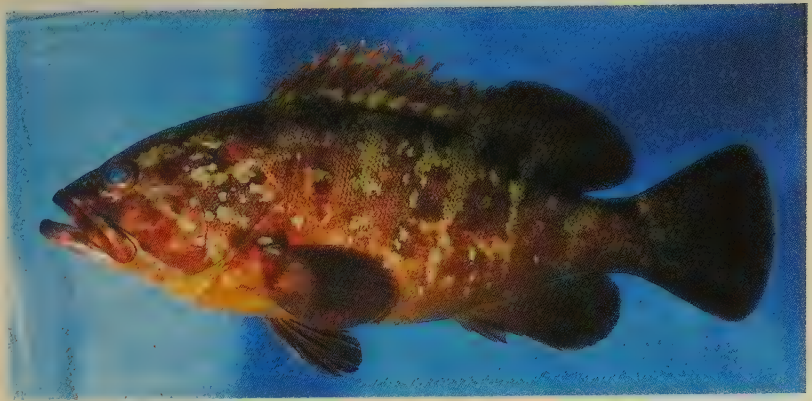


f) *Epinephelus magniscuttis*, 320 mm SL, Natal, South Africa (J.E. Randall)

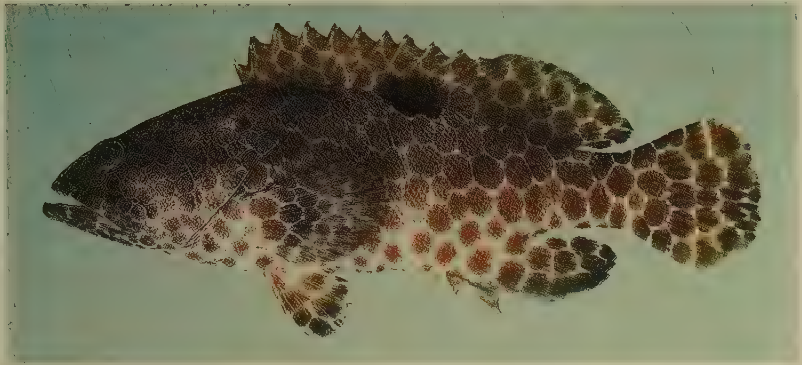
PLATE XVIII



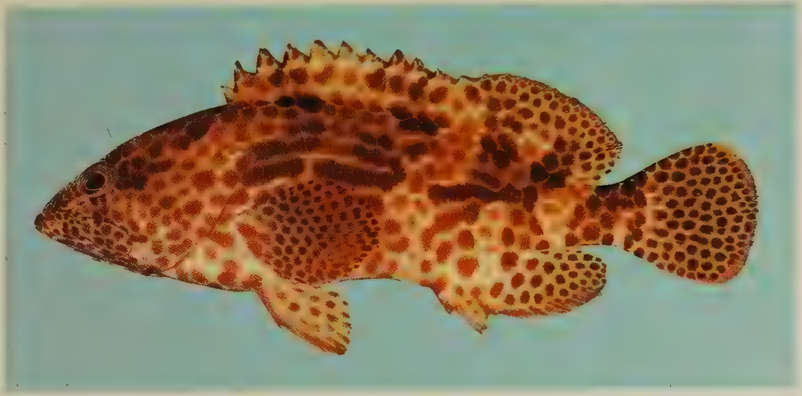
a) ***Epinephelus malabaricus***, 316 mm SL, Natal, South Africa
(J.E. Randall)



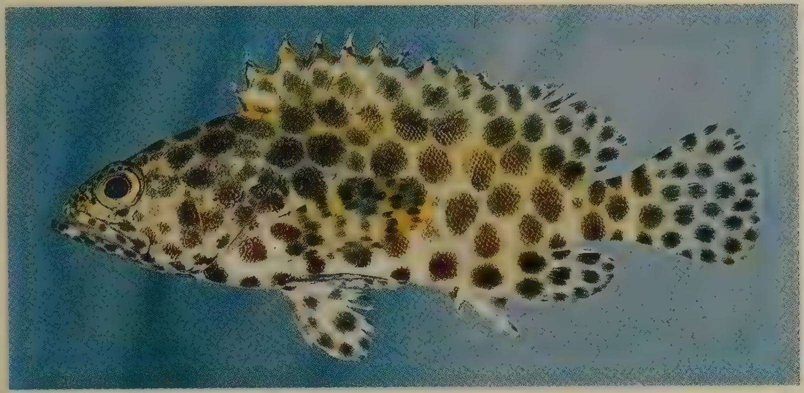
b) ***Epinephelus marginatus***, ~290 mm SL, Formigas, Azores
(P.C. Heemstra)



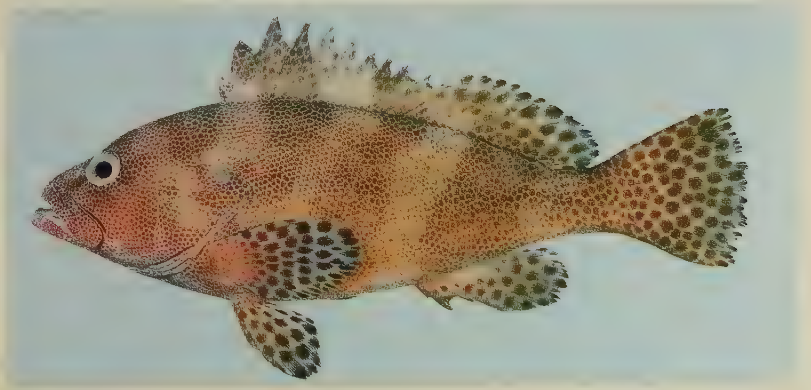
c) ***Epinephelus melanostigma***, 107 mm SL, Natal, South Africa
(J.E. Randall)



d) ***Epinephelus merra***, 172 mm SL, Tahiti, Society Islands
(J.E. Randall)

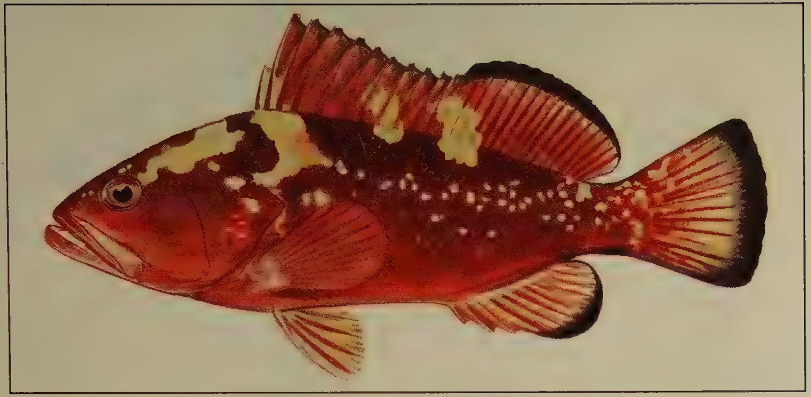


e) ***Epinephelus merra***, 63.3 mm SL, Peros, Chago Archipelago
(Burhos)

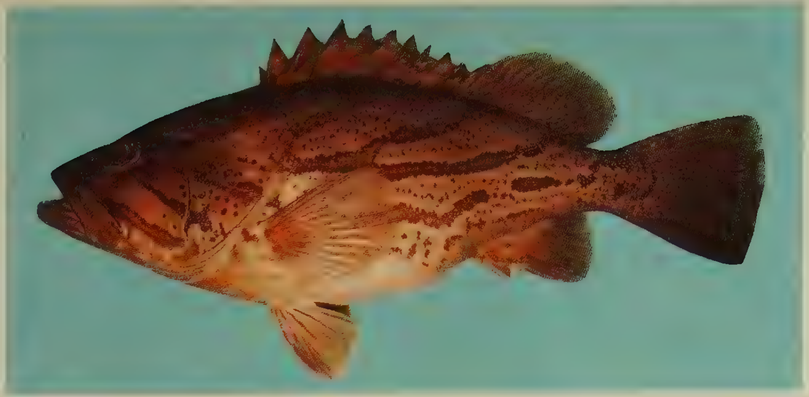


f) ***Epinephelus miliaris***, 430 mm SL, Bassas da India, Mozambique Channel
(P.C. Heemstra)

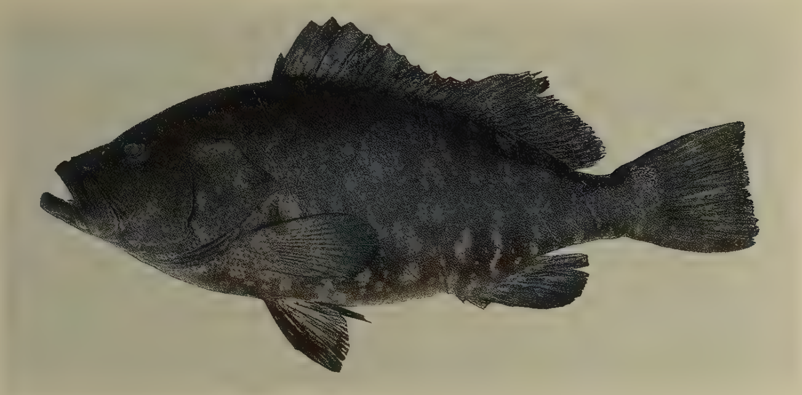
PLATE XIX



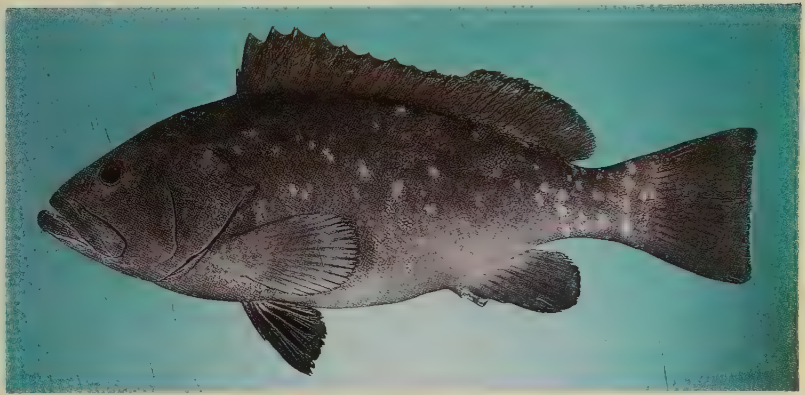
a) ***Epinephelus morio***, ~230 mm SL
(P. Lastrico)



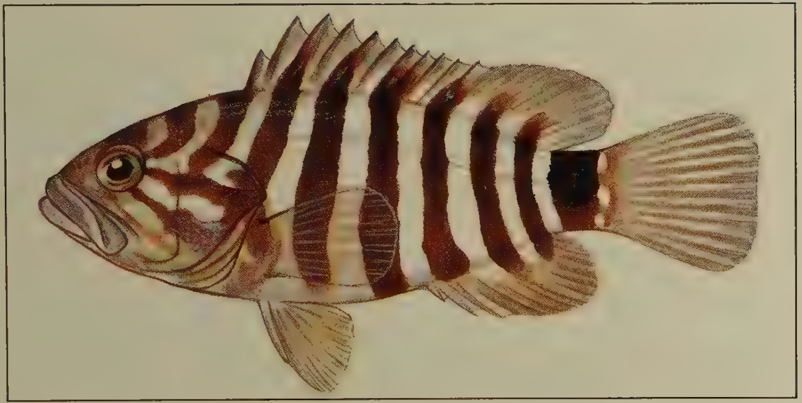
b) ***Epinephelus morrhua***, 512 mm SL, Maldive Islands
(J.E. Randall)



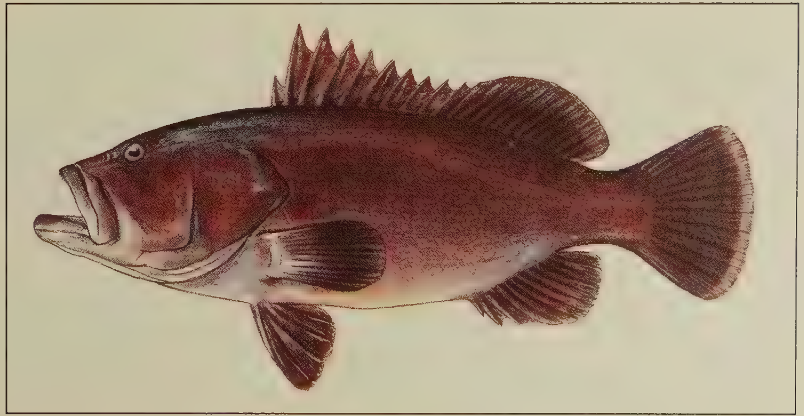
c) ***Epinephelus multinotatus***, 519 mm SL, southern Mozambique
(RUSI)



d) ***Epinephelus multinotatus***, 340 mm SL, Bahrain, Persian Gulf
(J.E. Randall)

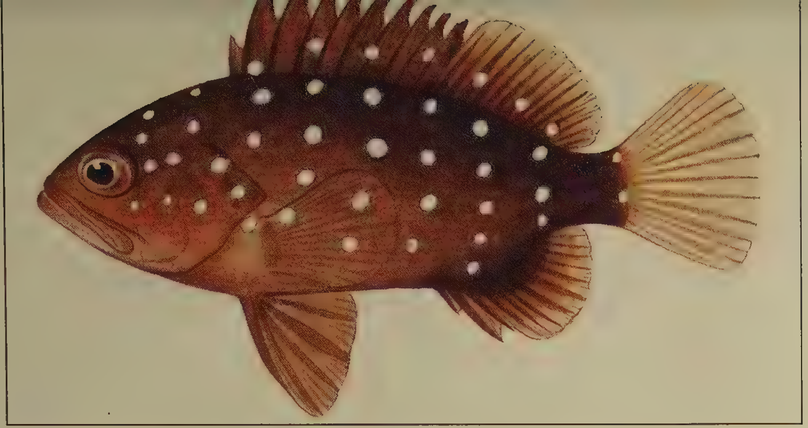


e) ***Epinephelus mystacinus***, ~60 mm TL
(P. Lastrico)

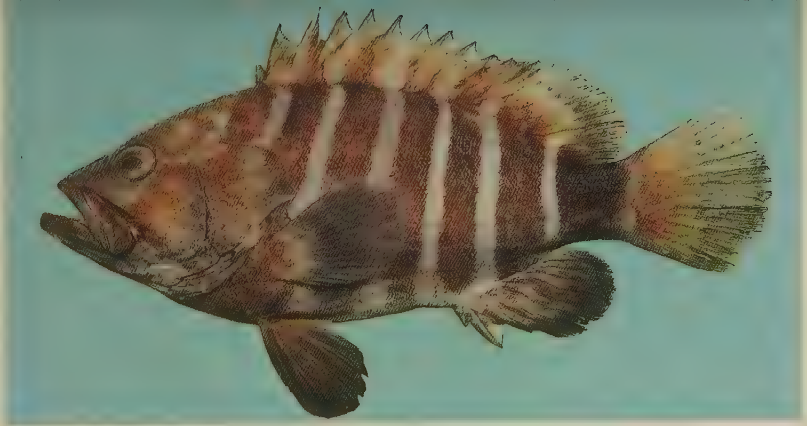


f) ***Epinephelus nigritus***, 600 mm SL
(P. Lastrico)

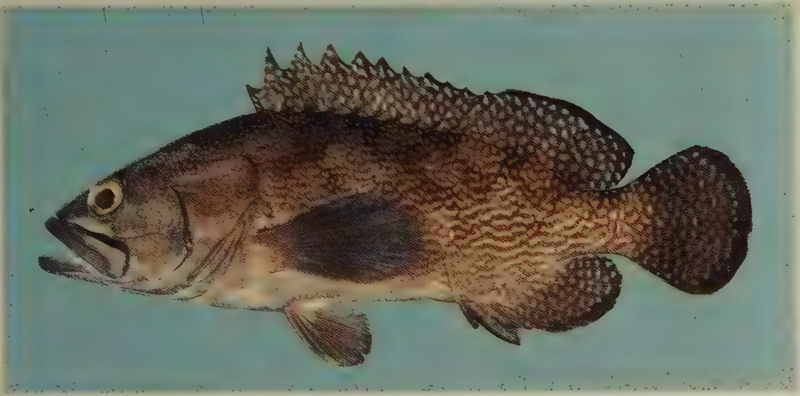
PLATE XX



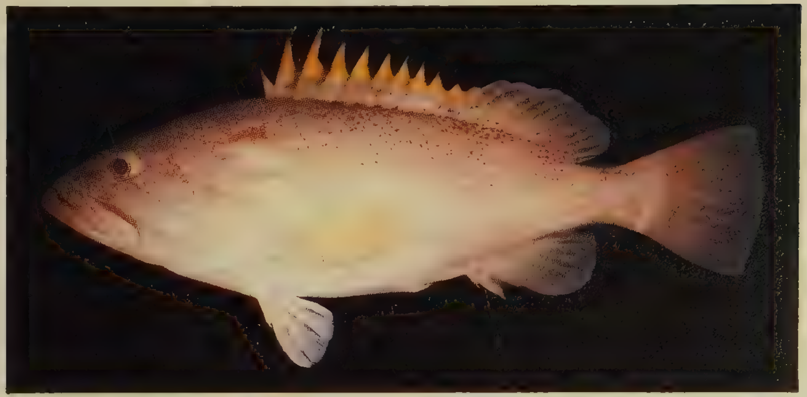
a) ***Epinephelus niveatus***, ~60 mm TL
(P. Lastrico)



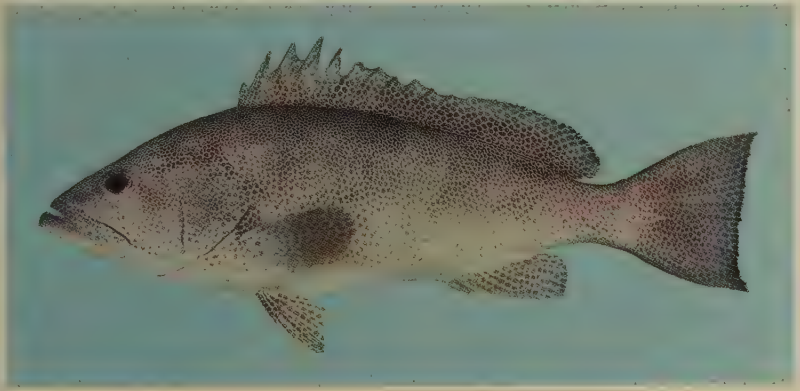
b) ***Epinephelus octofasciatus***, 228 mm SL, Okinawa, Japan
(J.E. Randall)



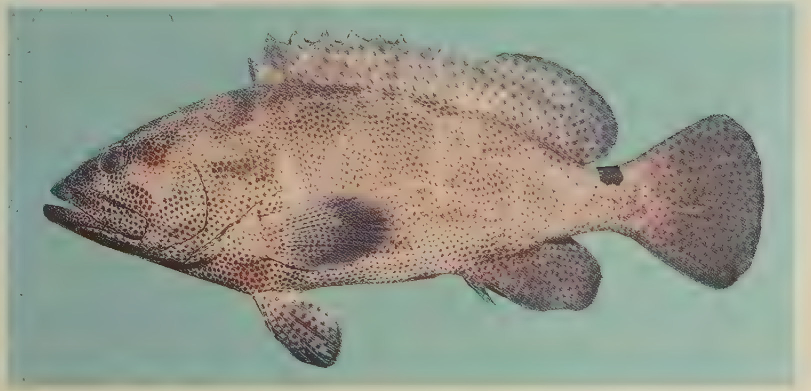
c) ***Epinephelus ongus***, 219 mm SL, Okinawa, Japan
(J.E. Randall)



d) ***Epinephelus poecilonotus***, 520 mm SL, Maldive Islands
(J.E. Randall)

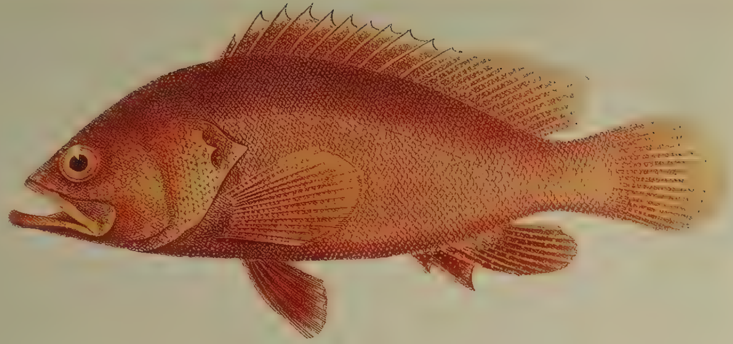


e) ***Epinephelus polylepis***, 440 mm SL, Bahrain, Persian Gulf
(J.E. Randall)

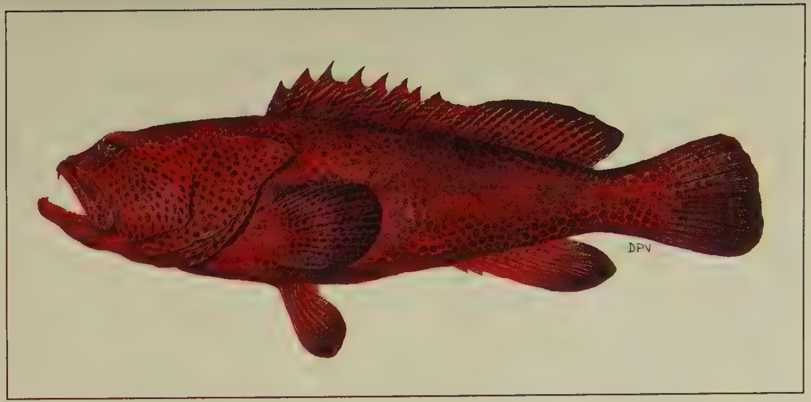


f) ***Epinephelus polyphekadion***, 408 mm SL, Sudan, Red Sea
(J.E. Randall)

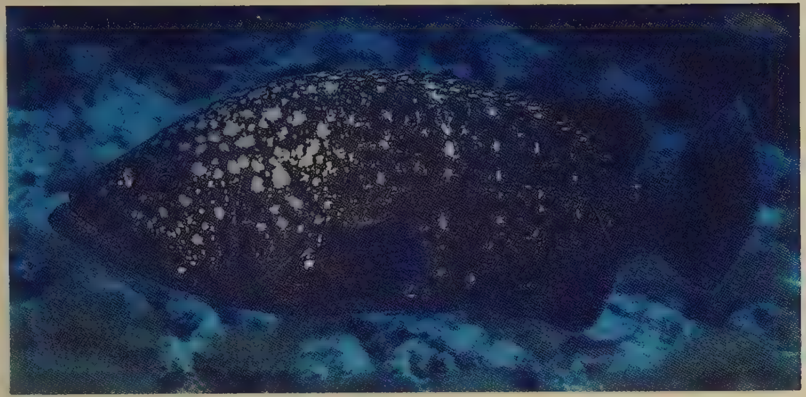
PLATE XXI



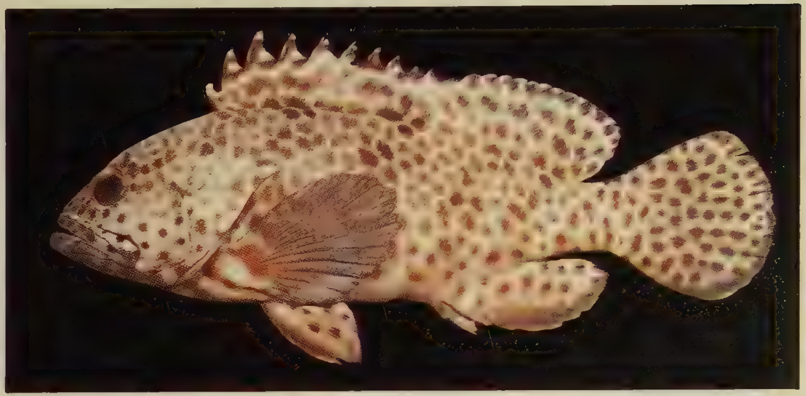
a) ***Epinephelus polystigma***, 245 mm TL, Indonesia
(Bleeker, 1873-76)



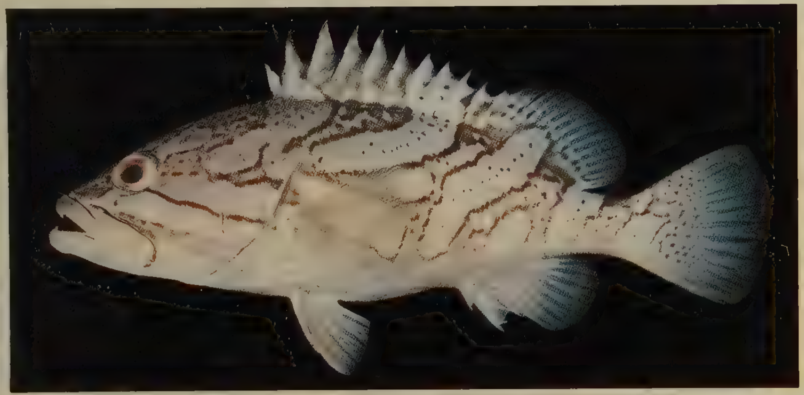
b) ***Epinephelus posteli***, 610 mm SL, Mozambique
(D.P. Voorvelt)



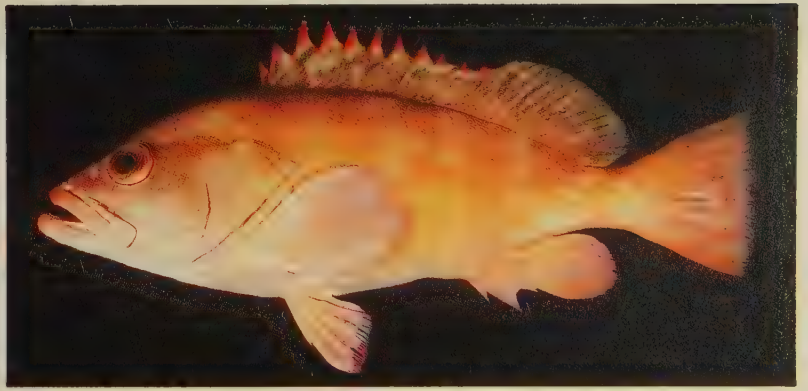
c) ***Epinephelus quernus***, ~550 mm TL, Midway, Hawaiian Islands
(J.E. Randall)



d) ***Epinephelus quoyanus***, 245 mm SL, Great Barrier Reef
(J.E. Randall)

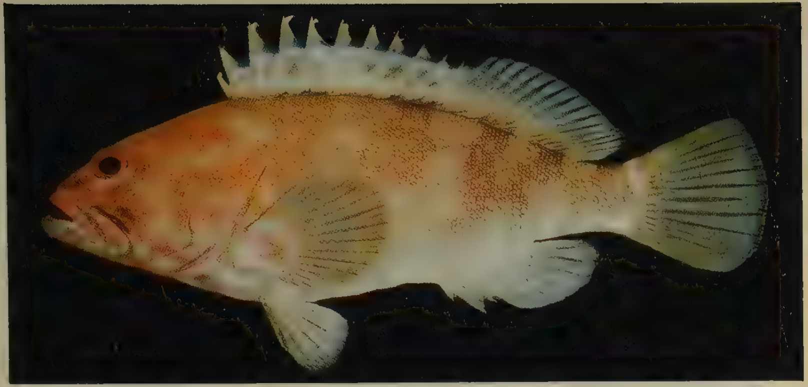


e) ***Epinephelus radiatus***, 282 mm SL, Okinawa, Japan
(J.E. Randall)

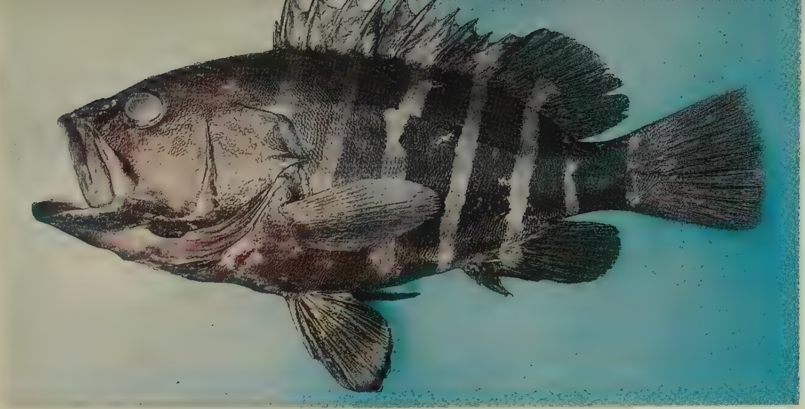


f) ***Epinephelus retouti***, 286 mm SL, Taiwan
(J.E. Randall)

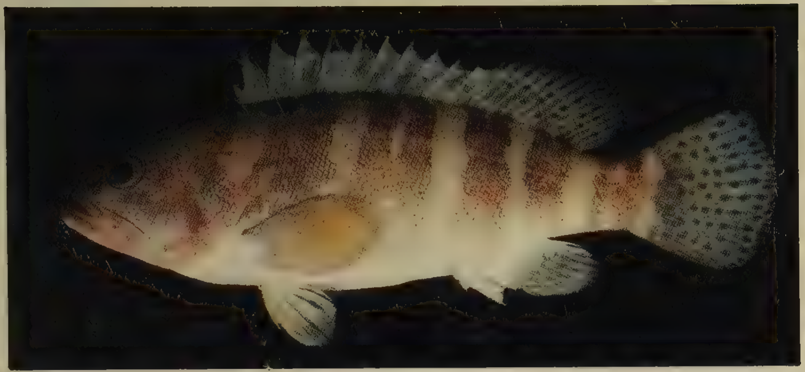
PLATE XXII



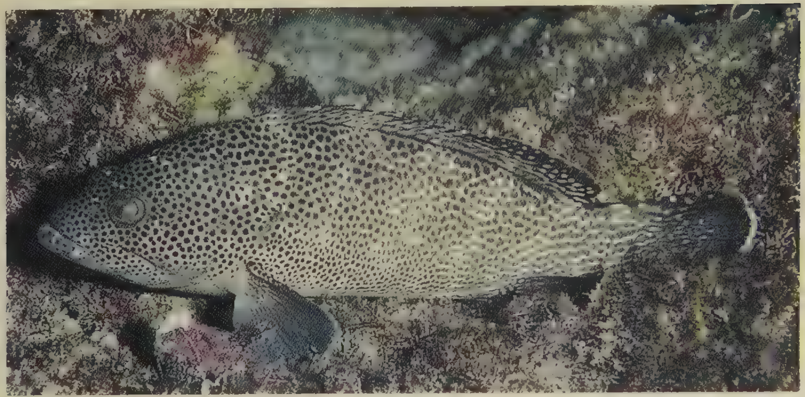
a) ***Epinephelus rivulatus***, 213 mm SL, Okinawa, Japan
(J.E. Randall)



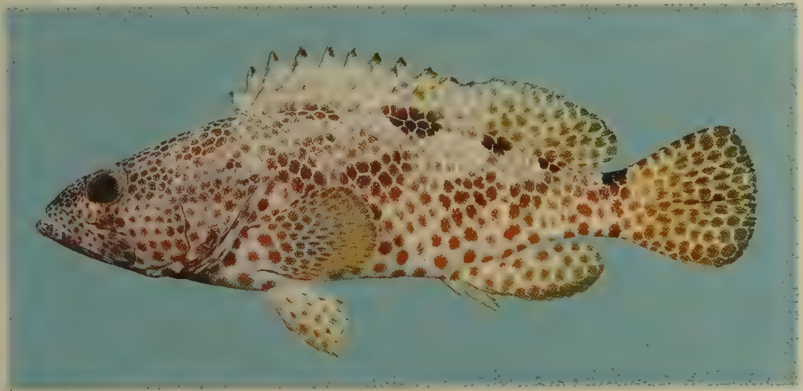
b) ***Epinephelus septemfasciatus***, 231 mm SL, Natal, South Africa
(P.C. Heemstra)



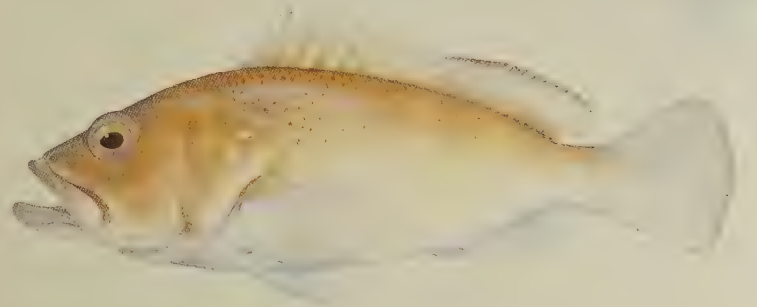
c) ***Epinephelus sexfasciatus***, 208 mm SL, Cebu, Philippines
(J.E. Randall)



d) ***Epinephelus socialis***, ~230 mm TL, Enewetak, Marshall Islands
(J.E. Randall)

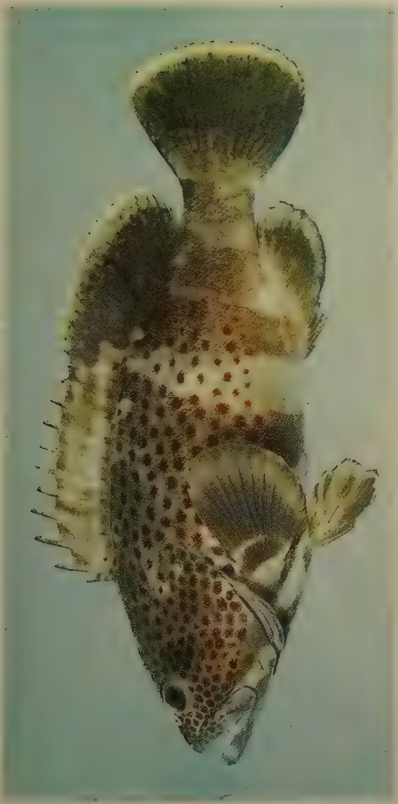


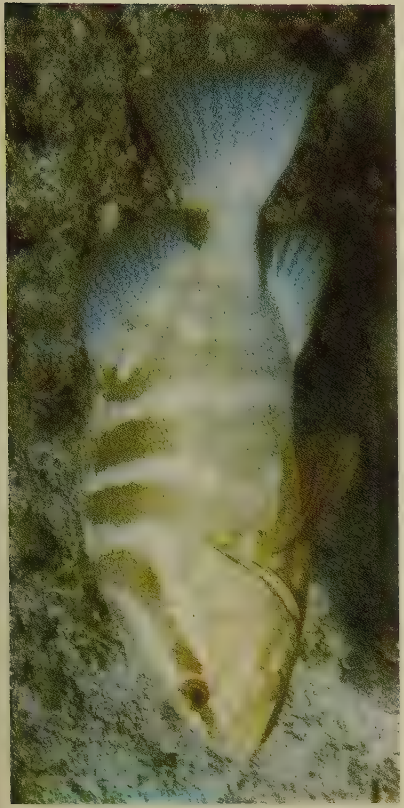
e) ***Epinephelus spilotoceps***, 189 mm SL, Kwajalein, Marshall Islands
(J.E. Randall)

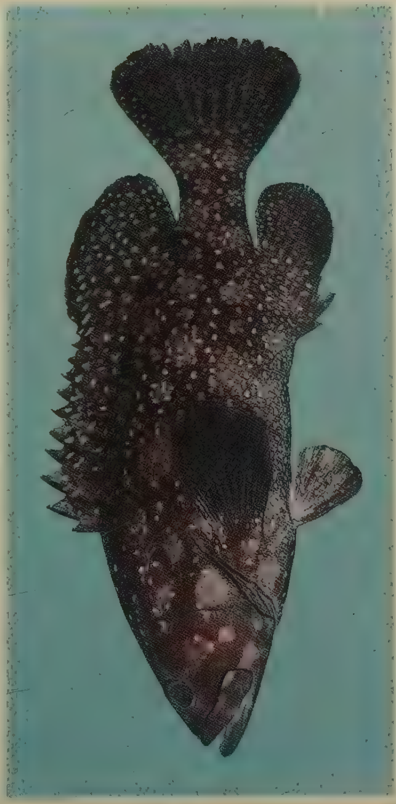


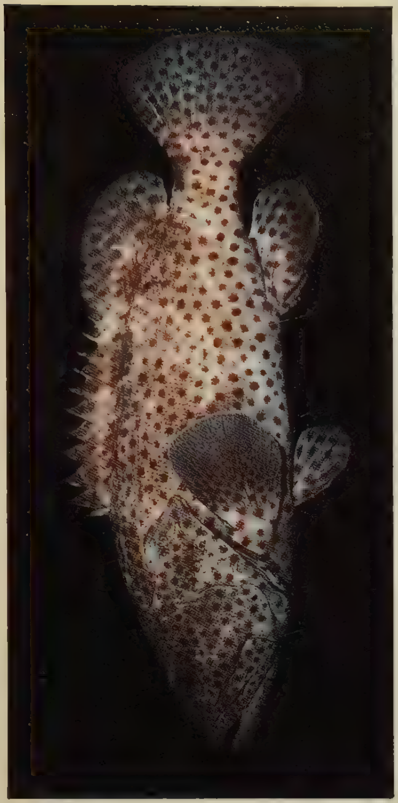
f) ***Epinephelus stictus***, 328 mm SL, Western Australia
(R. Swainston)

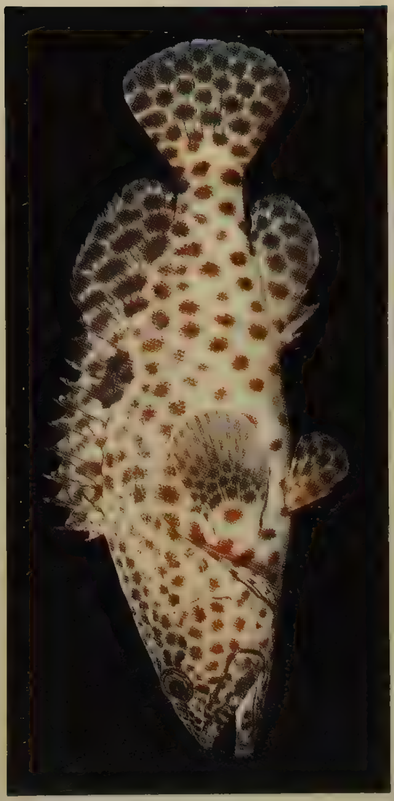
PLATE XXIII


a) *Epinephelus stoliczkae*, 198 mm SL, Mutrah, Oman
(J.E. Randall)


b) *Epinephelus striatus*, Long Island, Bahamas
(P.C. Heemstra)


c) *Epinephelus summana*, 334 mm SL, Sudan, Red Sea
(J.E. Randall)


d) *Epinephelus tauvina*, 407 mm SL, Sudan, Red Sea
(J.E. Randall)


e) *Epinephelus tauvina*, 191 mm SL, Enewetak, Marshall Islands
(J.E. Randall)

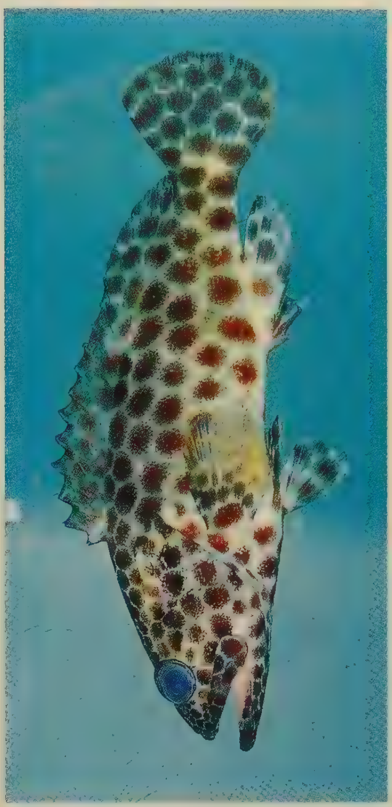
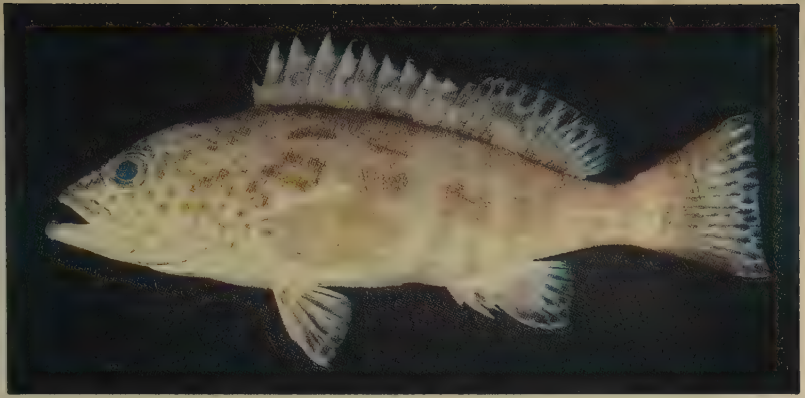
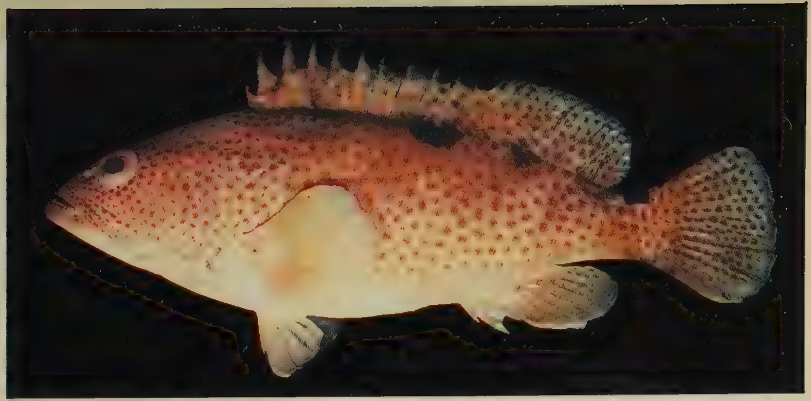

f) *Epinephelus tauvina*, 113 mm SL, Solomon Islands, Chagos Archipelago
(R. Winterbottom and A.R. Emery)

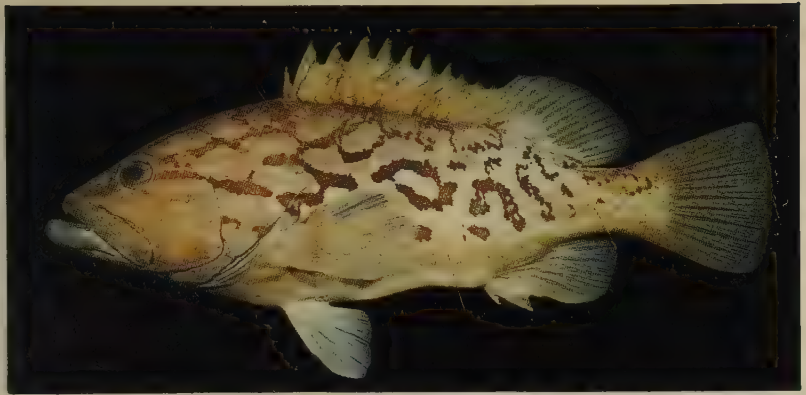
PLATE XXIV



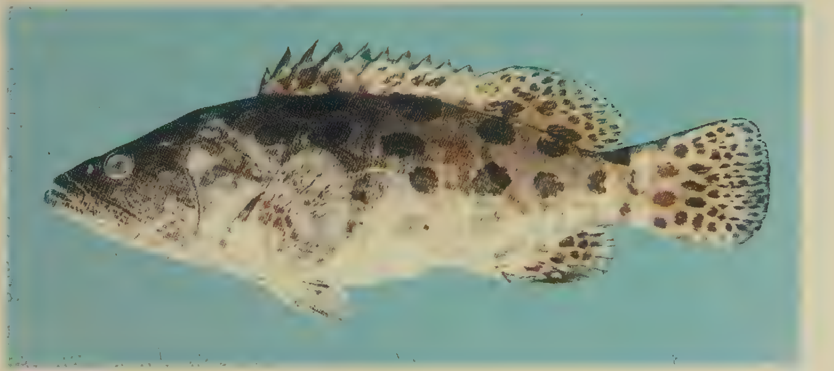
a) *Epinephelus timorensis*, 226 mm SL, American Samoa
(R. Wass)



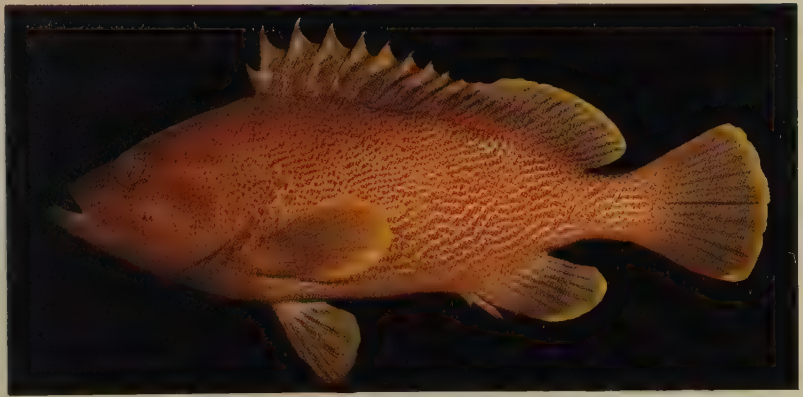
b) ***Epinephelus trimaculatus***, 269 mm SL, northern Taiwan
(J.E. Randall)



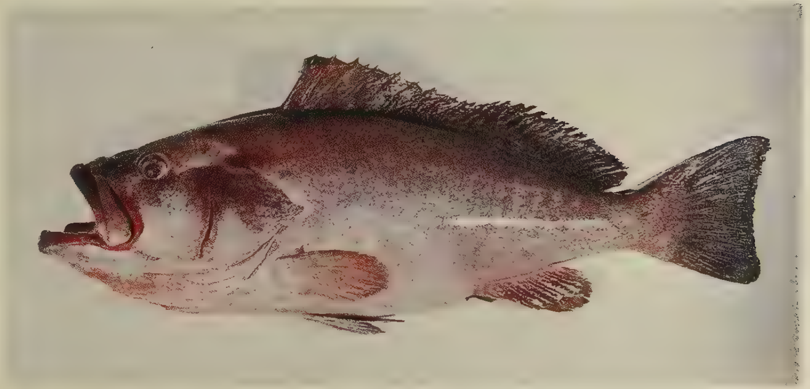
c) ***Epinephelus tuamotuensis***, 398 mm SL, Henderson Island, Pitchairn Group
(J.E. Randall)



d) ***Epinephelus tukula,*** 320 mm SL, Natal, South Africa
(P.C. Heemstra)

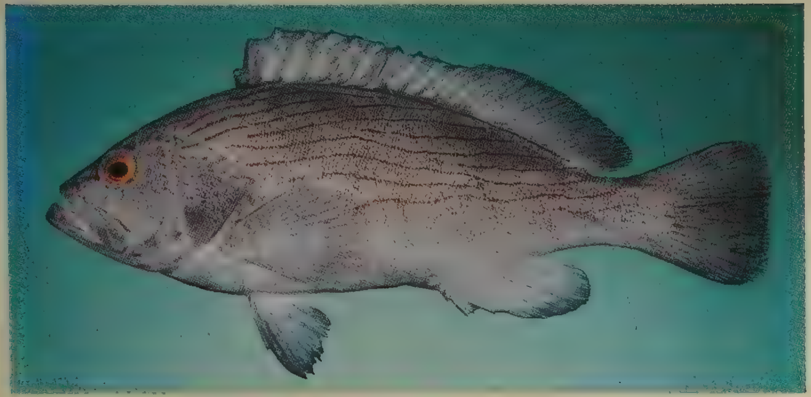


e) ***Epinephelus undulatostriatus***, 262 mm SL, Great Barrier Reef
(J.E. Randall)

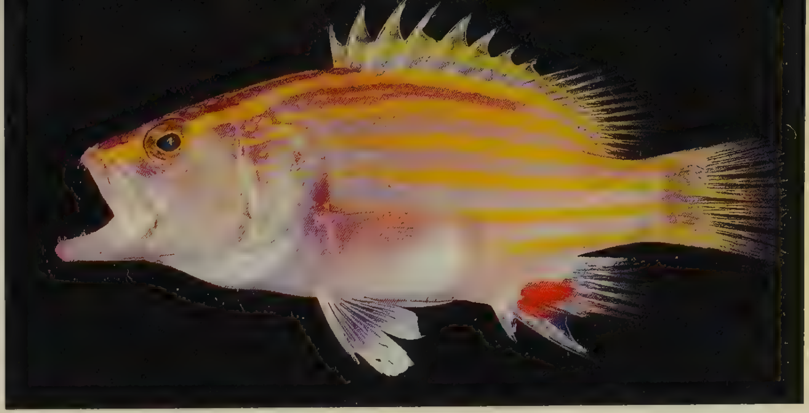


f) ***Epinephelus undulosus***, 600 mm SL, Kenya
(P.C. Heemstra)

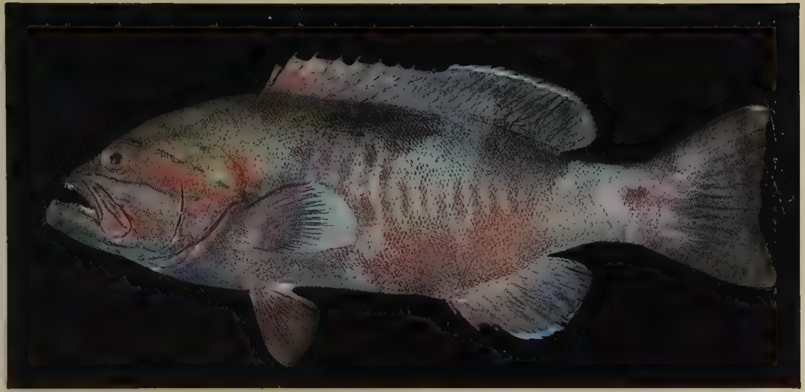
PLATE XXV



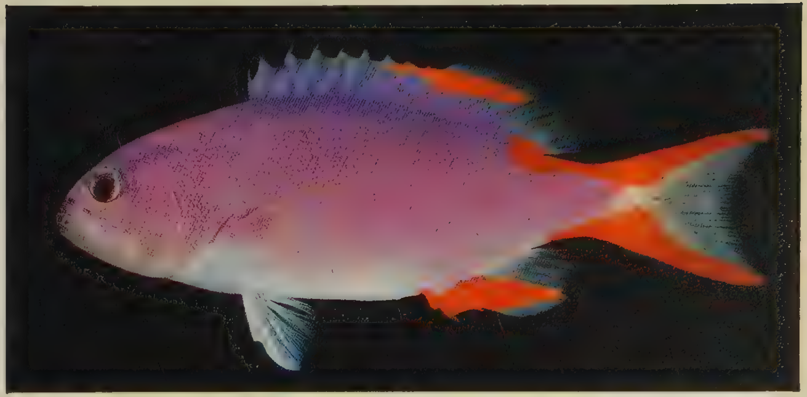
a) ***Epinephelus undulosus***, 159 mm SL, Negros, Philippines
(J.E. Randall)



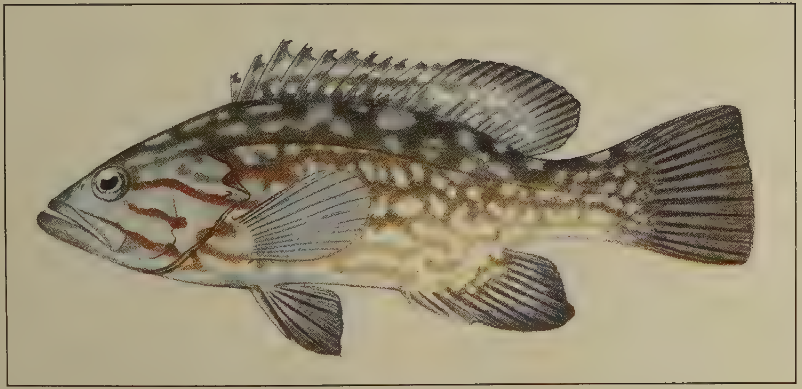
b) ***Gonioplectrus hispanus***, 105 mm SL, Puerto Rico
(P. Colin)



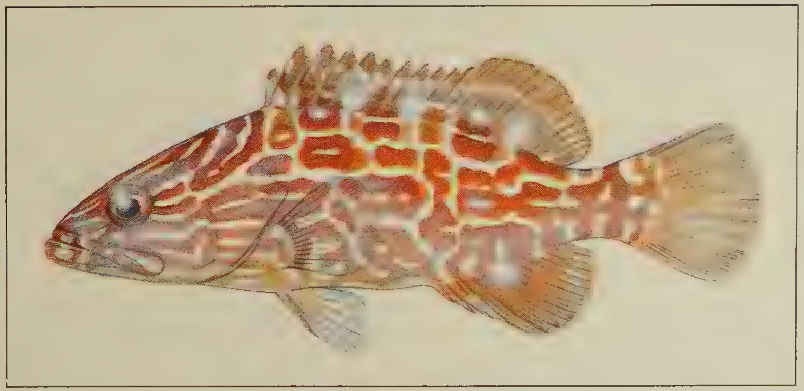
c) ***Gracila albomarginata***, 231 mm SL, Majuro, Marshall Islands
(J.E. Randall)



d) ***Gracila albomarginata***, 125 mm SL, Mauritius
(J.E. Randall)

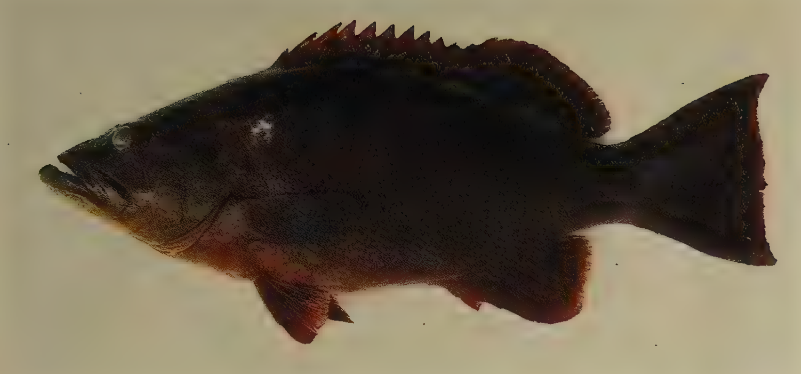


e) ***Mycteroperca acutirostris***, 175 mm SL
(P. Lastrico)

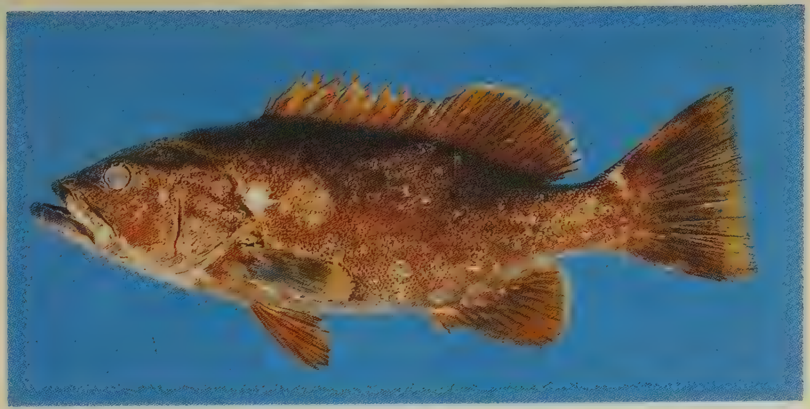


f) ***Mycteroperca bonaci***, 75 mm SL
(P. Lastrico)

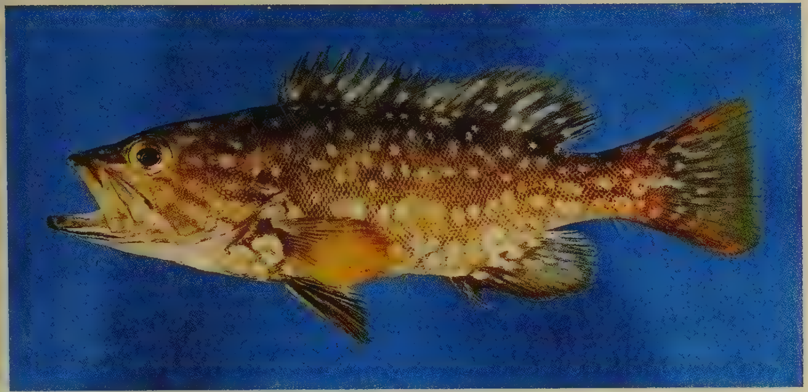
PLATE XXVI



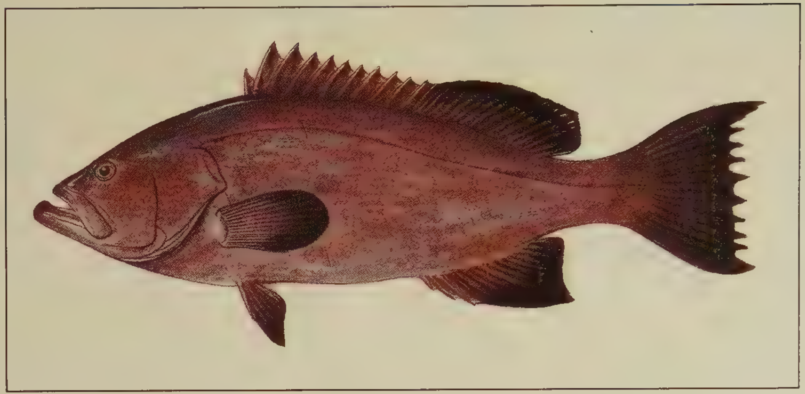
a) *Mycteroperca fusca*, 400 mm SL, Formigas, Azores
(P.C. Heemstra)



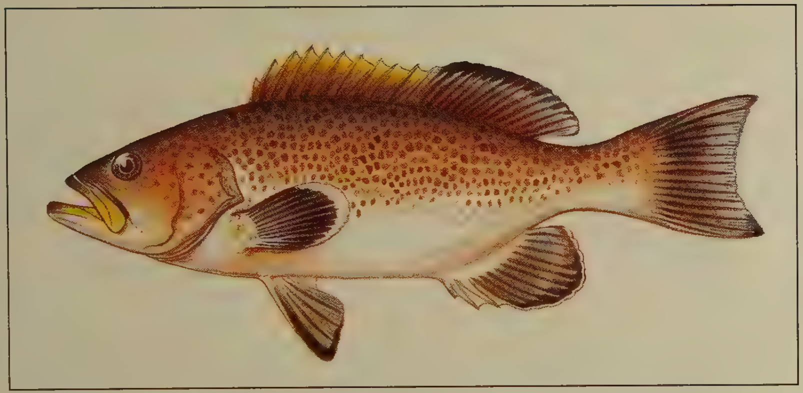
b) *Mycteroperca fusca*, 340 mm SL, Sta. Maria, Azores
(P.C. Heemstra)



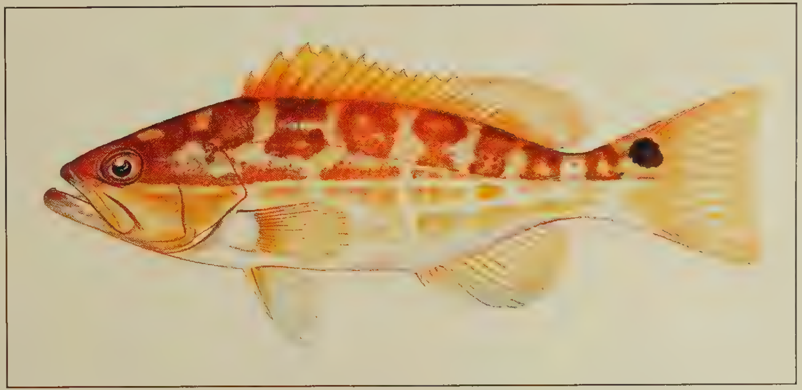
c) *Mycteroperca fusca*, 120 mm SL, Sta. Maria, Azora
(P.C. Heemstra)



d) *Mycteroperca interstitialis*, 400 mm SL, Gulf of Mexico
(P. Lastrico)

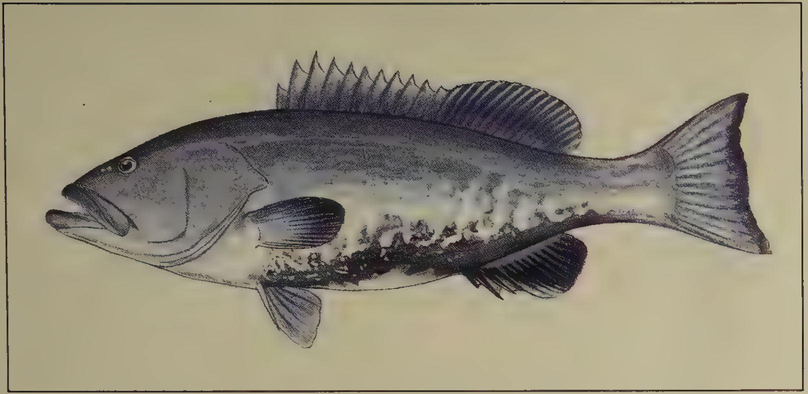


e) *Mycteroperca interstitialis*, 322 mm SL, Gulf of Mexico
(P. Lastrico)

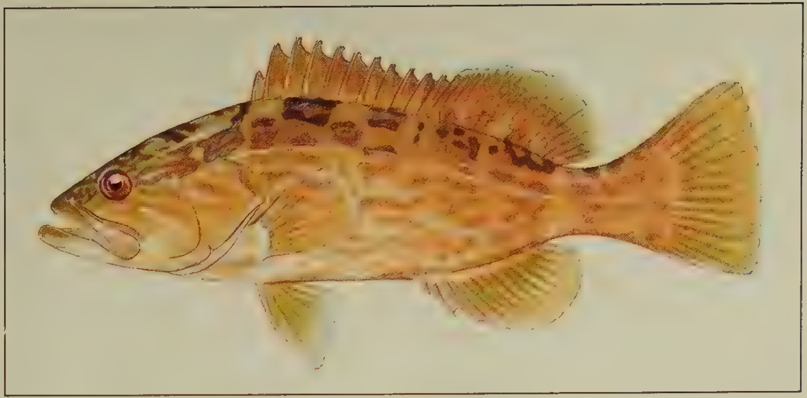


f) *Mycteroperca interstitialis*, 137 mm SL, Gulf of Mexico
(P. Lastrico)

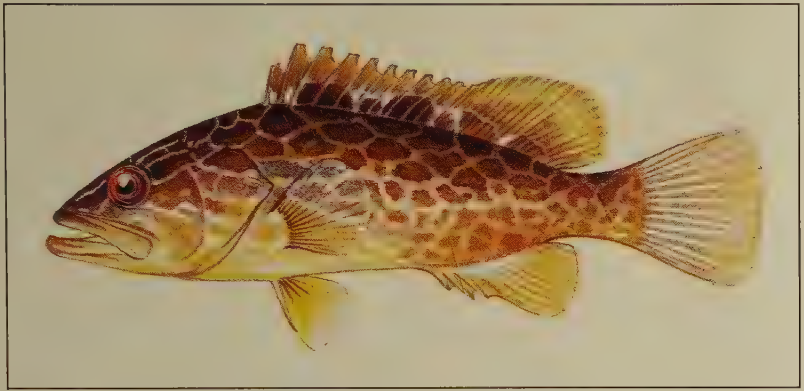
PLATE XXVII



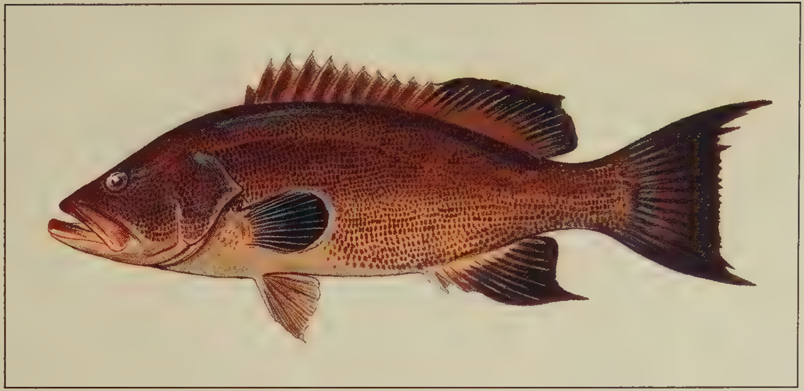
a) ***Mycteroperca microlepis***, 951 mm SL, Gulf of Mexico
(P. Lastrico)



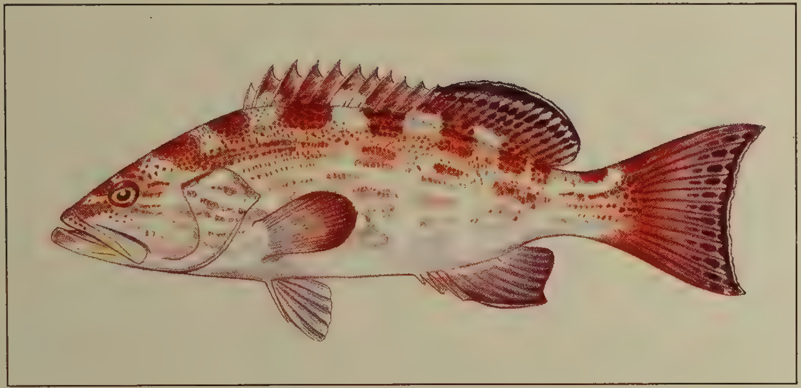
b) ***Mycteroperca microlepis***, 235 mm SL, Gulf of Mexico
(P. Lastrico)



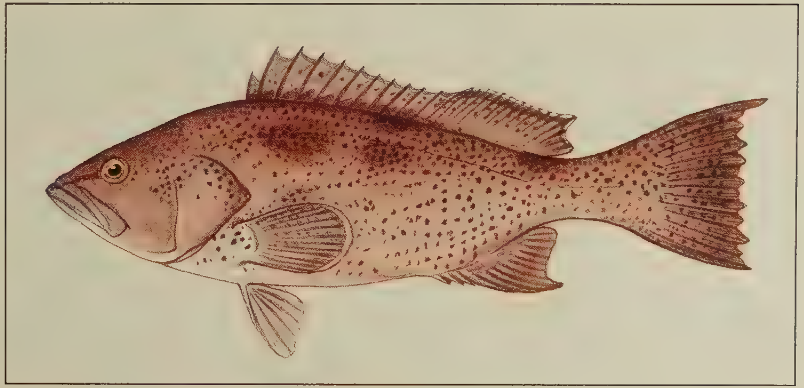
c) ***Mycteroperca microlepis***, 40 mm SL, Gulf of Mexico
(P. Lastrico)



d) ***Mycteroperca phenax***, 500 mm SL, Gulf of Mexico
(P. Lastrico)

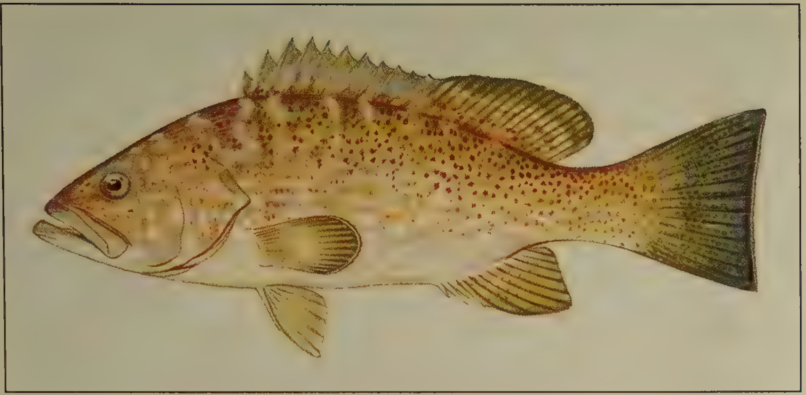


e) ***Mycteroperca phenax***, 240 mm SL, Gulf of Mexico
(P. Lastrico)

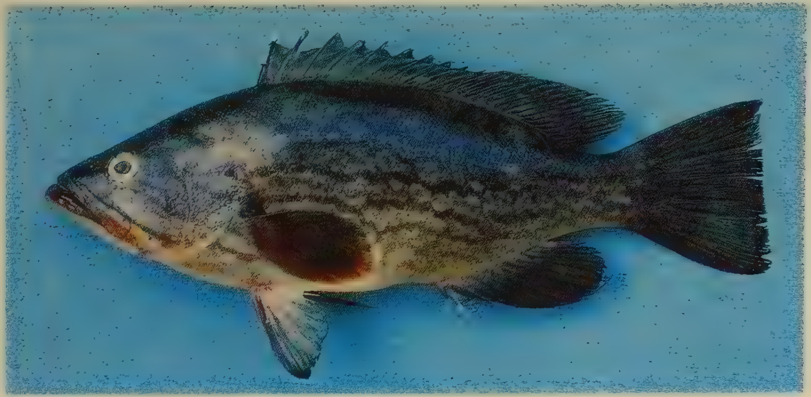


f) ***Mycteroperca prionura***, 500 mm SL, Gulf of Mexico
(P. Lastrico)

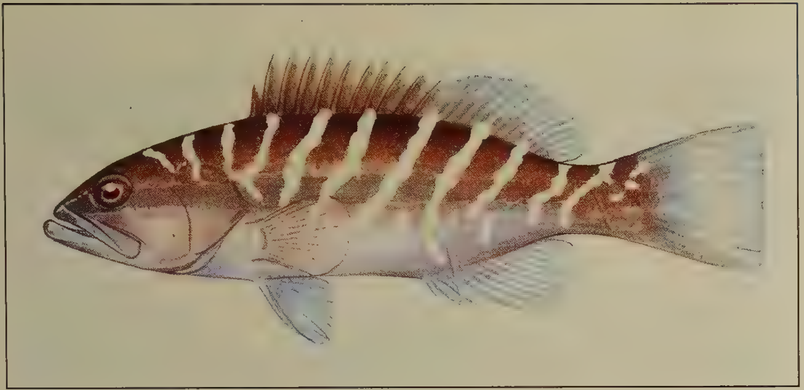
PLATE XXVIII



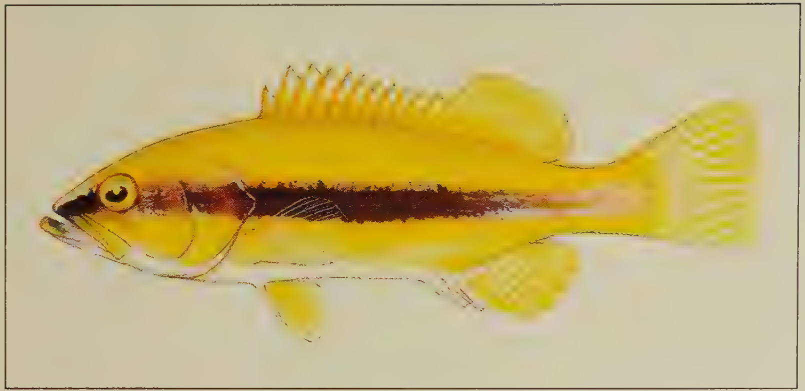
a) ***Mycteroperca rosacea***, 500 mm SL, Gulf of Mexico
(P. Lastrico)



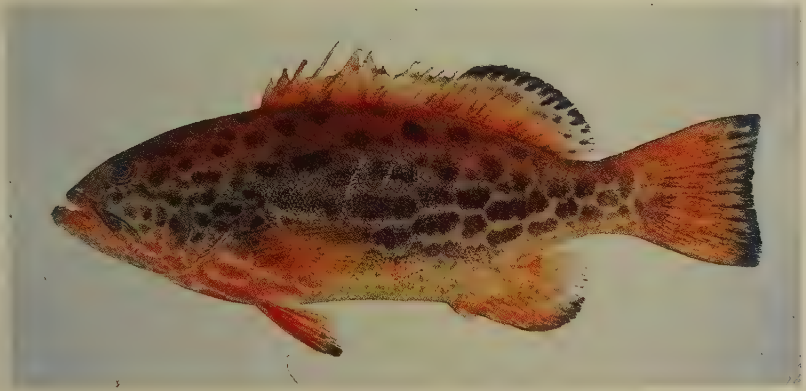
b) ***Mycteroperca rubra***, Senegal
(M. Bellemans)



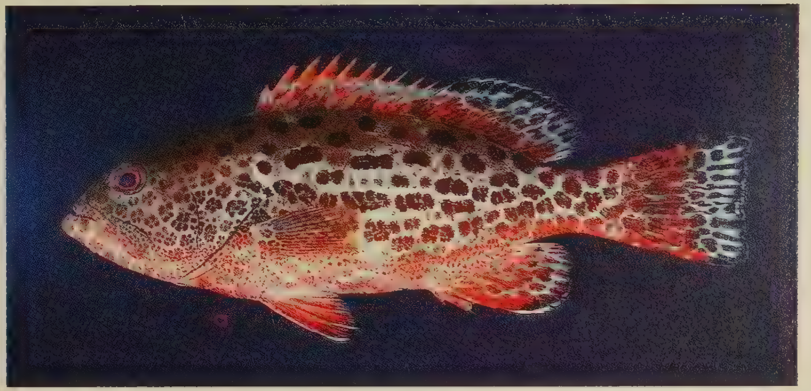
c) ***Mycteroperca tigris***, 90 mm SL, Gulf of Mexico
(P. Lastrico)



d) ***Mycteroperca tigris***, 90 mm TL, Gulf of Mexico
(P. Lastrico)

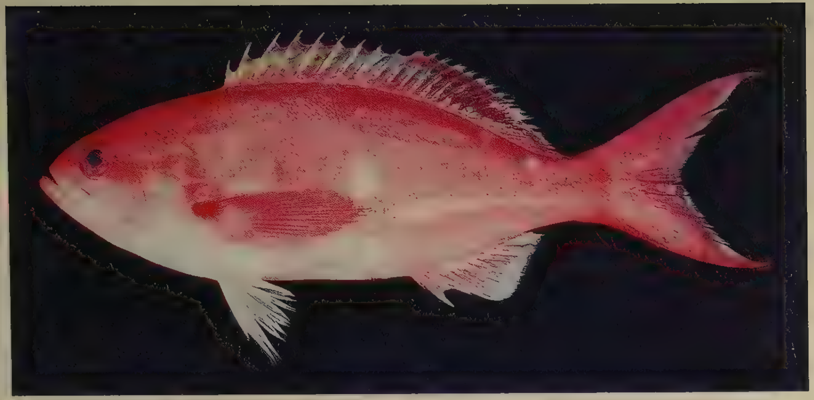


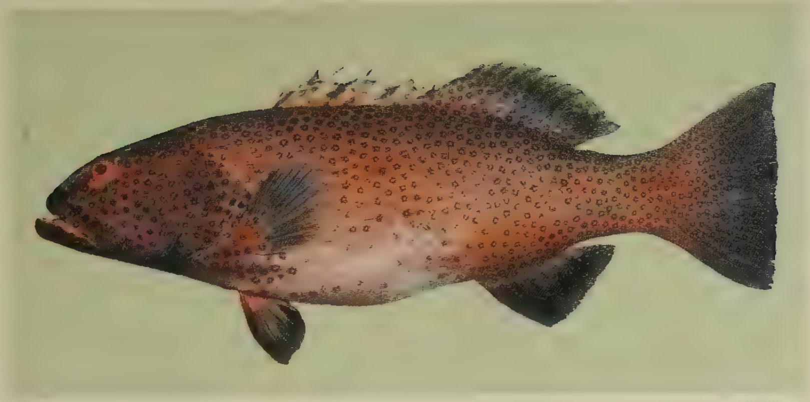
e) ***Mycteroperca venenosa***, 235 mm SL, shallow water, Puerto Rico
(P.C. Heemstra)

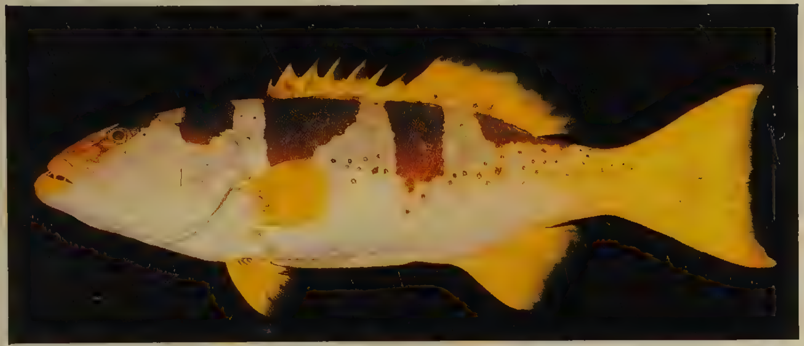


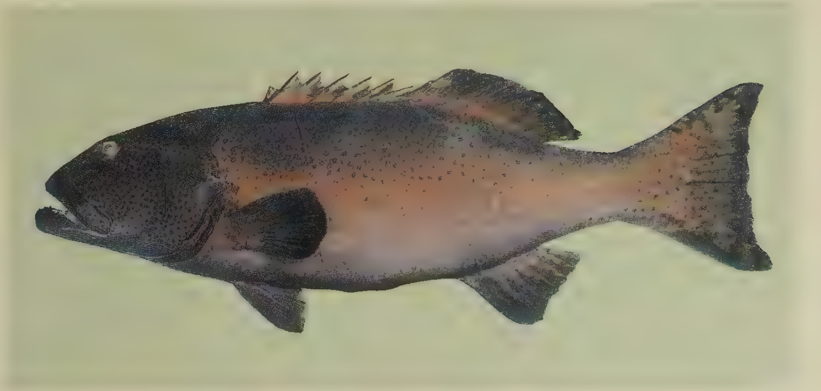
f) ***Mycteroperca venenosa***, 176 mm SL, deep water, St. John, Virgin Islands
(J.E. Randall)

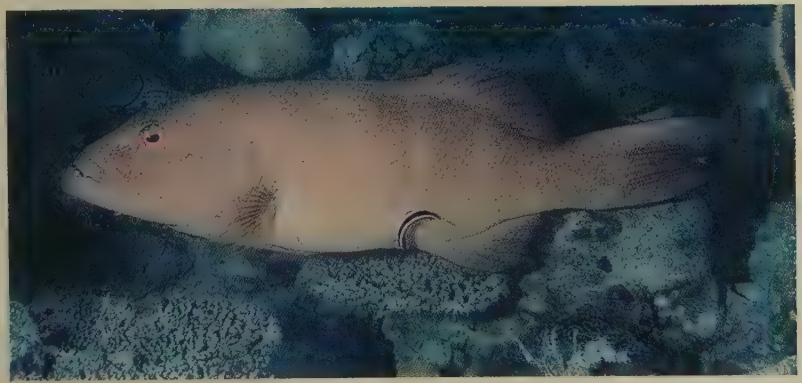
PLATE XXIX


a) ***Paranthias furcifer***, Suriname/Trinidad
(J. Kilding)


b) ***Plectropomus areolatus***, 374 mm SL, Sudan, Red Sea
(J.E. Randall)


c) ***Plectropomus laevis***, 597 mm SL, Enewetak, Marshall Islands
(J.E. Randall)


d) ***Plectopomus laevis***, 475 mm SL, Enewetak, Marshall Islands
(J.E. Randall)


e) ***Plectropomus leopardus***, 500 mm SL, Chesterfield Islands, Coral Sea
(J.E. Randall)

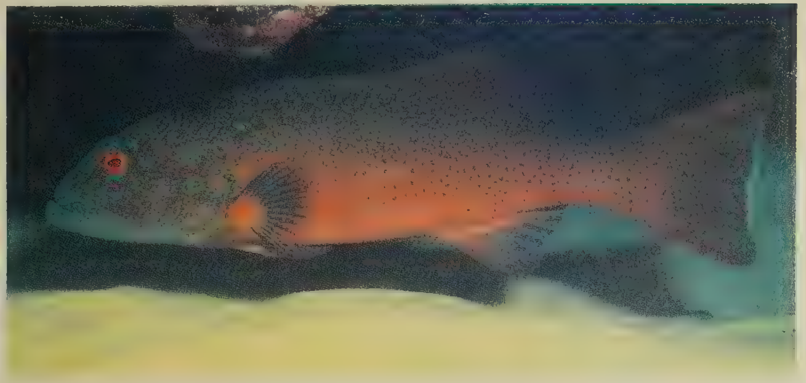
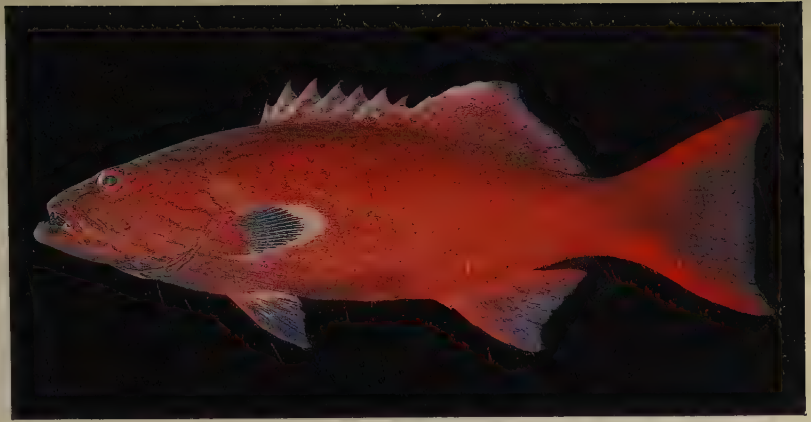
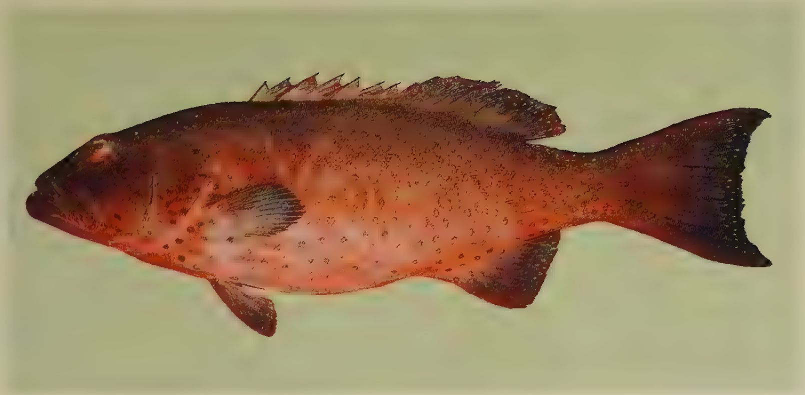

f) ***Plectropomus maculatus***, Exmouth Gulf, Western Australia
(N. Coleman)

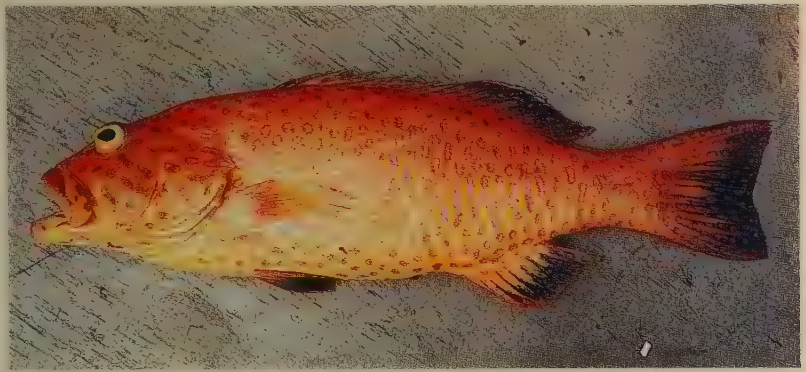
PLATE XXX



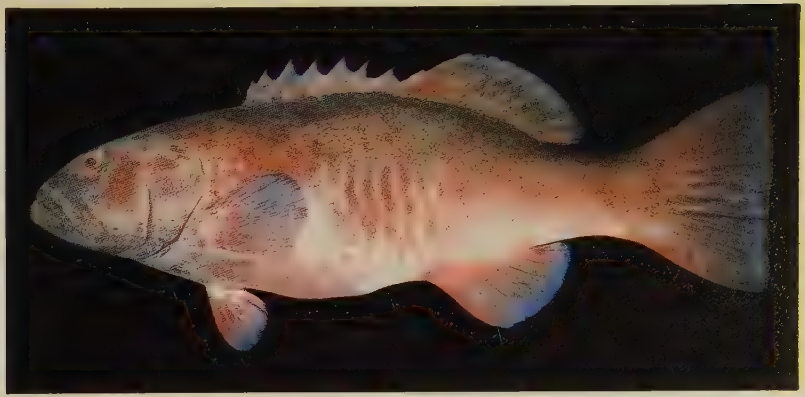
a) ***Plectopomus oligacanthus***, 241 mm SL, Malaita, Solomon Islands
(J.E. Randall)



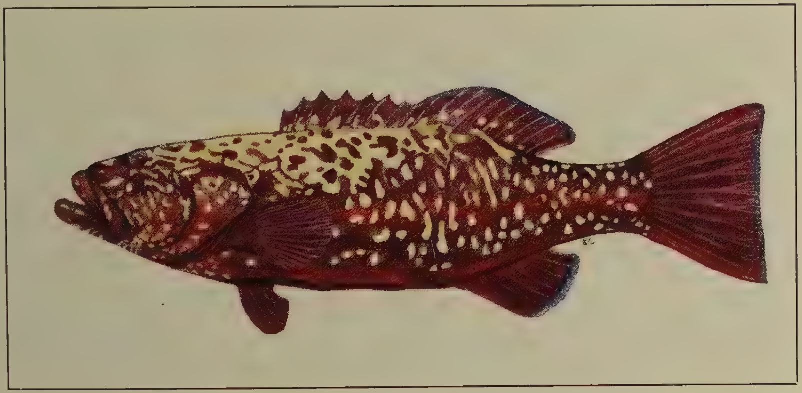
b) ***Plectopomus pessuliferus***, 480 mm SL, Gulf of Aqaba, Red Sea
(J.E. Randall)



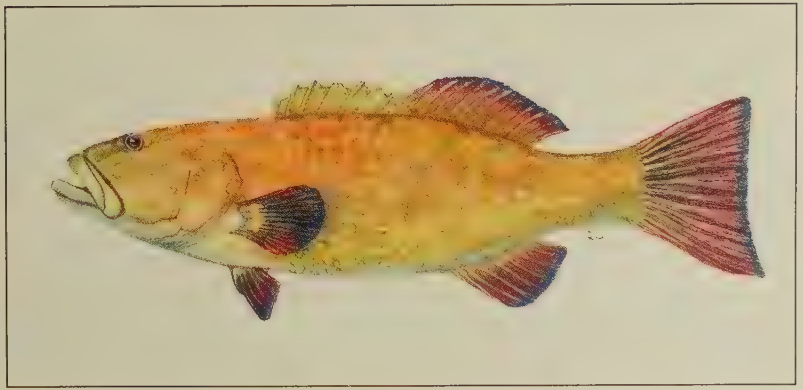
c) ***Plectopomus pessuliferus***, 392 mm SL, Ovalaua, Fiji
(A. Lewis)



d) ***Plectopomus punctatus***, 446 mm SL, Mahé, Seychelles
(J.E. Randall)

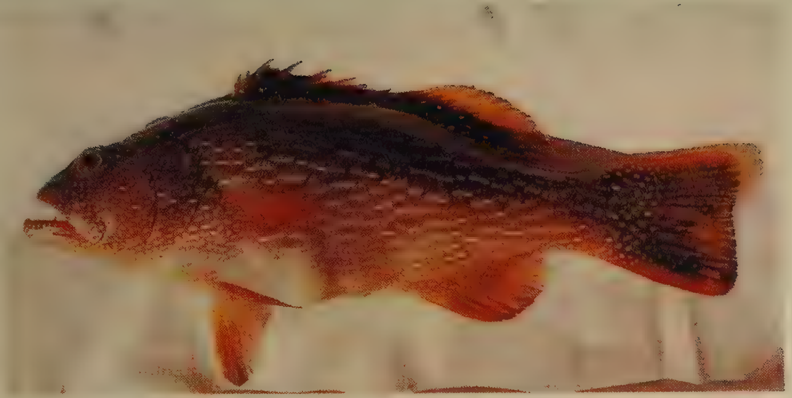


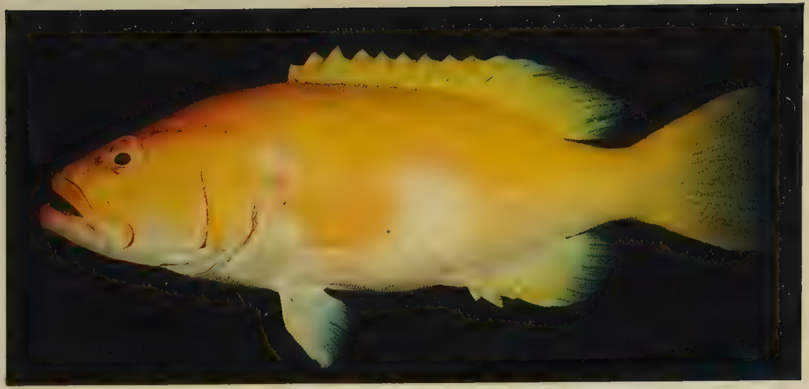
e) ***Plectopomus puncataus***, 900 mm TL
(E. Heemstra)

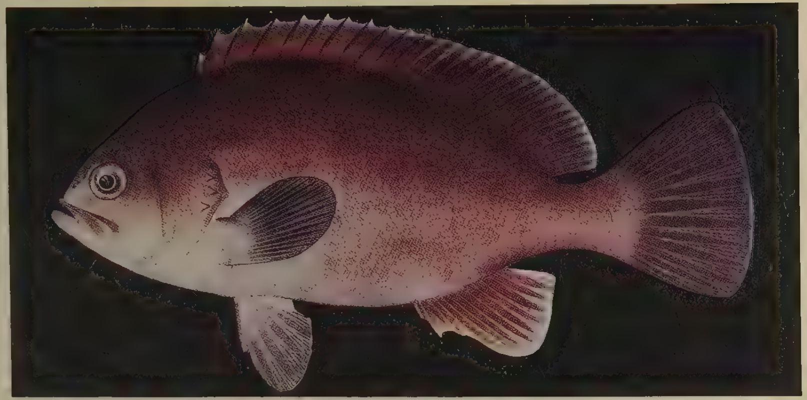


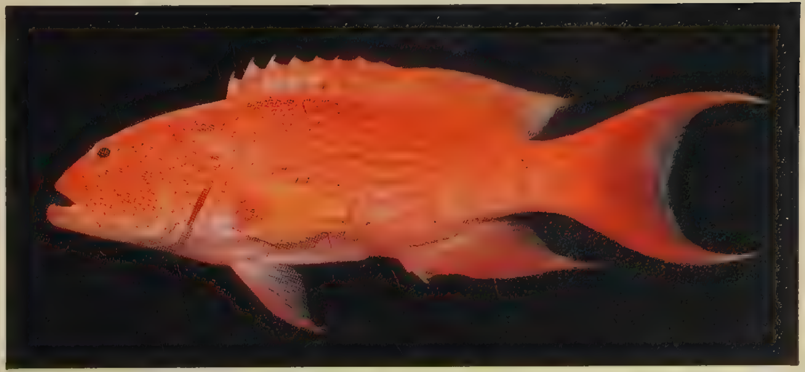
f) ***Plectopomus punctatus***, 900 mm TL
(E. Heemstra)

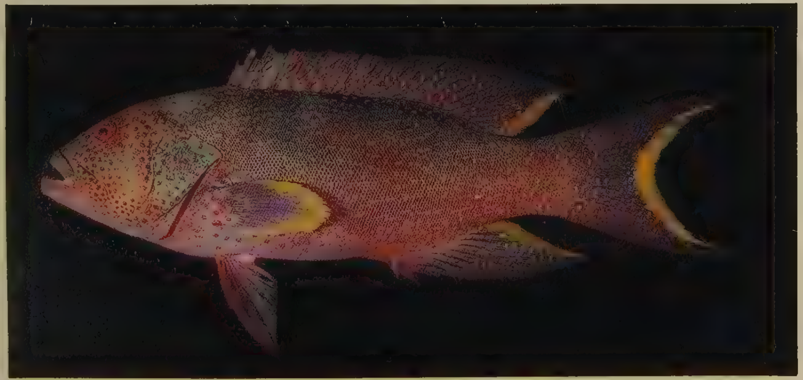
PLATE XXXI

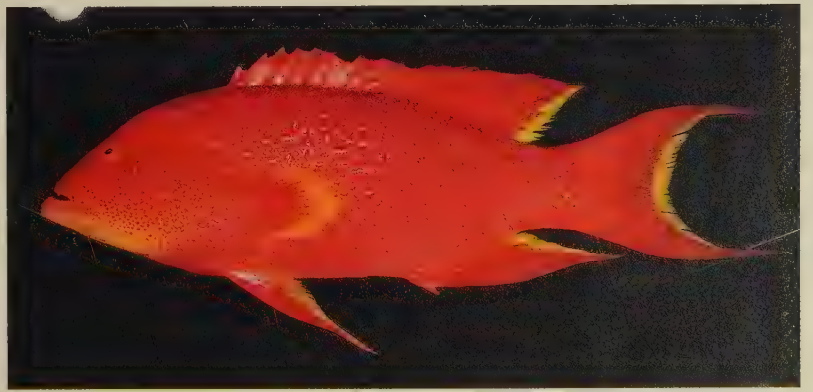

a) *Plectopomus punctatus*, ~200 mm TL, Mauritius


b) *Saloptia powelli*, 385 mm SL, Guam, Mariana Islands
(J.E. Randall)


c) *Triso dermopterus*, 245 mm SL, southern Japan
(Hiyama and Yasuda, 1961)


d) *Variola albimarginata*, 212 mm SL, Mauritius
(J.E. Randall)


e) *Variola louti*, 267 mm SL, Enewetak, Marshall Islands
(J.E. Randall)


f) *Variola louti*

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